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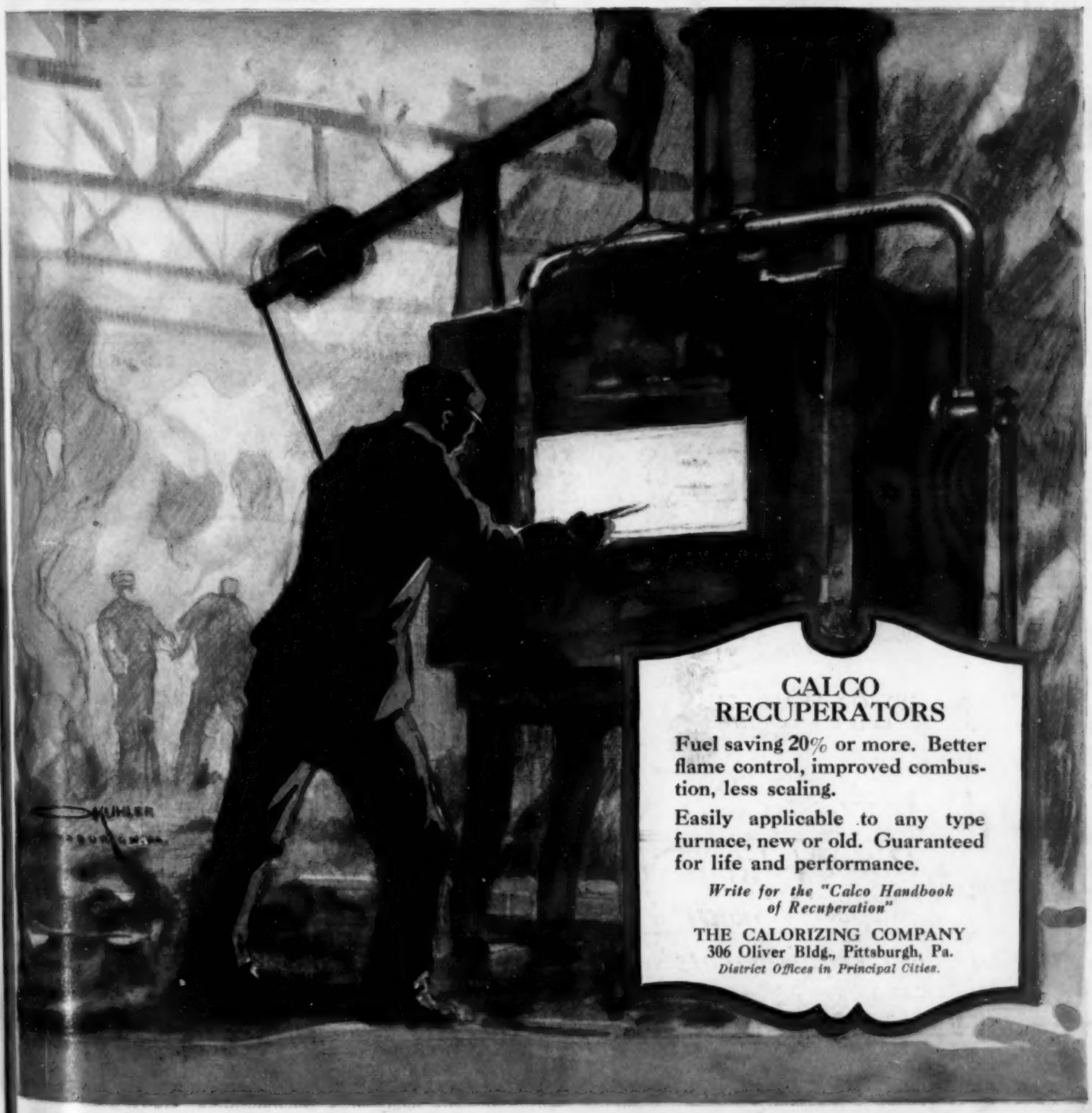

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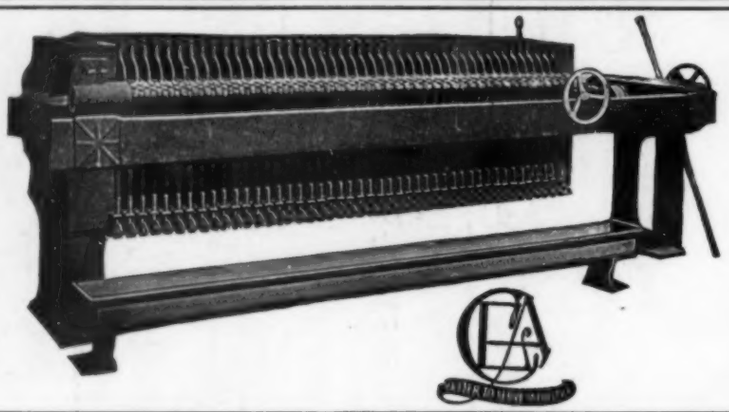

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H. C. PARMELEE, Editor

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Chemistry in Terms of War

RECENT issues of the daily papers carry reports of a great discovery made at the Fixed Nitrogen Research Laboratory in Washington. These reports annoy us a little, not because we feel that any of the details should be kept from the public nor yet because of the extremely loose, inaccurate and untechnical language in which some newspapers present the subject, but principally on account of the wrong emphasis that our journalists insist upon placing on chemical achievement.

To illustrate the point we quote one headline verbatim: "Greatest Discovery in Atoms Gives U. S. Giant War Weapon." Overlook, if you please, the exaggeration and inaccuracy. The real fault lies in the emphasis on war. Why should the dailies constantly disregard the economic significance of each new chemical discovery? Why must the public be falsely educated to look upon the chemical engineer's work as one primarily of preparation for war? The situation suggests a professional duty of paramount importance—namely, to lead the newspapers and the public to stop thinking of chemical engineering as a potential agency of destruction and recognize it for the essentially beneficent, civilizing, industrial force that it is.

Co-operation in Fundamental Research

THAT fundamental research is the foundation upon which true technical progress must rest has long been recognized. Experience has shown, however, that it is difficult for the average plant to conduct work of this character. When operating problems arise that threaten to interfere with production, there is a natural tendency to neglect the fundamental and concentrate upon work having more immediate bearing on production. In general, better results from fundamental research will be obtained by laboratories entirely separate from the plant, such as those maintained by trade associations, or separate even from the industry, as is the case with universities, government bureaus and industrial research organizations. Unfortunately this very independence which permits uninterrupted work often produces data of little direct value to industry. If the investigators were more familiar with industrial conditions, the same effort would develop results of much greater utility.

An investigation illustrating the point is that of a government laboratory on the viscosity of molten glass. Measurement of this factor involves a high degree of scientific skill and it would be quite natural for men engaged in this work to select glass batches that are primarily of scientific interest, such as optical glass. A little reflection will show, however, that data on such a glass would be of direct benefit to only a very small part of the glass industry, probably less than 5 per cent. On the other hand, data on glasses more nearly approaching the character and composition of commercial window, plate and bottle batches would be of immediate interest to a large number of plants representing a substantial percentage of the total production.

It is encouraging to note that the research organization in question, the Bureau of Standards, has adopted the latter course and is busily engaged in collecting data which the industry will be able to use immediately. Technical men in the industry have been quick to express appreciation of this evident understanding of their needs and the bureau may be assured of their support in its work. Co-operation of this character is essential if fundamental research data are to be translated into technical progress rapidly and efficiently.

Agitating a Slurry Economically

ONE of the difficult tasks in some of the chemical engineering industries is the handling and storing of a slurry. Perhaps as good an example as any is found in the average wet-process cement plant. Here it is necessary to store a slurry of finely ground limestone and shale containing roughly 33 per cent of water. The slurry must be stored until it has been analyzed in the laboratory and the ratio of limestone to shale corrected. In this interim it must not be allowed to settle, which of course means that it must be stirred in some way.

The orthodox methods of stirring slurry are two. The most widely used method consists of a large paddle with blades set at an angle of 45 degrees. It does not require a very vivid imagination to realize that the amount of power necessary in this operation is out of proportion to the results achieved. As a matter of fact a tank of slurry often requires 10 to 15 hp., depending on its size, to accomplish agitation by this method.

A second and quite common method of stirring is by means of air. In a 30-ft. tank air is forced upward through the slurry from a dozen to twenty pipes extending to within a foot of the bottom. Naturally the air is not applied continuously, but is turned on for perhaps 5 minutes every hour. This is less expensive than the first method as far as power is concerned, but it requires considerable attention from the operating men, which is, of course, a drawback.

Two newer methods have recently come to our attention which show that in some quarters at least constructive thought is being given to the problem. In one plant a screw propeller with an upward push is being installed in a 30-ft. tank. Small-scale experiments indicate that it has economical possibilities and *a priori* it would seem safe to predict a saving in power.

The other system is in use in several plants and makes use of what is substantially a Dorr agitator. In

principle it consists of a tank with a slowly rotating central shaft, at the bottom of which are two radial arms carrying rakes. The latter travel near the bottom of the tank and move the settling material toward the center, where it is forced up the inside of the shaft by means of an air lift. From the top of the shaft it flows into radial troughs or launders rotating above the surface, having perforations in the bottom, from which the slurry is again distributed to the tank. Finally the charge is partly kept from settling by forcing air through it from the submerged arms carrying the rakes. This system has had considerable success in handling reaction mixtures in other industries with good results. It is claimed that the saving in power amounts to nearly 75 per cent over the paddle stirrer.

At present both of these systems are so new that replacement and operating costs are not available, but the developments will bear watching, for the problem is one that involves a considerable item of cost.

The Cost of Filtration— An Impetus for Intelligent Production

ENGINEERS and production men generally are not well trained in cost accounting. In fact, they are usually not trained at all, their acquaintance with the subject being developed from having to make out production reports. Thus there has grown up a certain glibness in the use of accounting phraseology without any background or understanding of fundamentals.

Into this rather gloomy picture there comes a real ray of light. In this issue appears an article by W. G. Whitman and Tyler Fuwa entitled "Cost of Filtration Equipment and Operation." With the generous co-operation of specialists in this field and of manufacturers of various types of filtration equipment they have accumulated a unique set of data. These data they have reduced to a logical common denominator and have then constructed a complete set of filtration costs, using the three most common types of filters. The value of this is twofold. Not only does it present a quantitative method of predicting filtration costs but it discusses each factor in such a way as to emphasize its meaning as a unit of cost.

Those familiar with cost accounting may differ from the authors in certain of the estimates they have made. This is inevitable, for there is considerable flexibility in accounting procedure. For example, in estimating costs it is fully as legitimate to omit the interest charge on capital invested and allow it to show up as profits as to charge a definite rate of interest to cost, as is done by the authors. Again, the depreciation charges used by the authors are much lower than those used in many companies. In fact, it is not uncommon practice to demand that a new piece of equipment liquidate itself within a single year. This in some cases is the criterion upon which a decision to purchase is reached. On the other hand, every estimate made in the article is indorsed by industrial practice and may therefore be followed with confidence.

This article is the first of a series of similar articles on other unit processes of chemical engineering, including evaporation, drying, grinding, etc. It is the first approach in the literature to one of the most important problems that is met by every production man, "What is it going to cost to do this job with this equipment?" It bespeaks a new era in which the hitherto omnipotent but unreliable "hunch" will be replaced by an intelligent differentiation of equipment on a basis of installation and operating cost. How many decisions have been reached in the past on a basis of initial cost of equipment without regard to the other charges so clearly delineated in the present article!

Collecting Data on Corrosion-Resistant Alloys

THE American Society for Testing Materials committee on corrosion-resistant alloys, working under the chairmanship of Jerome Strauss of the Washington Navy Yard, has undertaken a difficult but important task—the collection under one cover of available information regarding the properties of all metals that may be considered corrosion resistant. This information is being gathered in several ways, one of the most important of which is through a questionnaire. The committee is asking every manufacturer to give it as much information as possible regarding the composition and properties of the material it is marketing. At the present time there is no summary of information of this sort and the user of such alloys is often seriously in doubt as to the availability of material suited to his peculiar needs. The work of the committee, therefore, promises to fill an important gap in our fund of technical information.

Manufacturers may at first be terrified by the length and complexity of the questionnaire, but they should not allow this to deter them from hearty co-operation with this committee. All of the information that can properly be supplied should be furnished promptly. If this is done, the resulting report of the committee will be of value not alone to alloy users but also to the manufacturers. It is hoped that the industry will cordially support this undertaking.

We Enjoy Being Fooled

WHEN Barnum said that the people of the United States enjoyed being tricked, he hit near the mark, as most of us will agree. It has been our entertaining duty from time to time to record many pseudo-scientific hoaxes; and in most of these frauds it is noticeable that when they are exposed in all their ridiculous misrepresentations the gulled public seems amused rather than indignant.

Lately one Tomadelli, a self-styled great electrical inventor, has been imposing on the public with a so-called perpetual electric light. Certain mysterious experiments were carried on in Argentina, but an alleged stroke of lightning unfortunately destroyed all the results of these experiments and left the great invention solely in the inventor's mind. In this predicament he landed on our hospitable shores and with its usual bounty the public received him, purse strings open, and bought liberally of the securities of the company organized to exploit Tomadelli's canned sunlight. Now comes the exposure of the hoax, and with the possible exception of those whose good money has been lost the public merely grins and seemingly applauds the defrauder.

Perhaps there is no moral in this oft-repeated story. Maybe Americans are born to be hoaxed, but it does seem as though constant repetition of this cycle of events should by this time rouse the public to the point of exercising greater caution. Possibly when the public grows weary of its amusement it will exercise the existing authority and means to put an end to such abuses.

An Industry Organizes for Progress

The Institute of American Meat Packing Is the Vigorous Indorsement by a Gigantic Industry of the Idea of Co-operative Research and Education

LESS than 5 years ago the American Meat Packers Association held a convention and emerged with a new title. Thereafter it was known as the Institute of American Meat Packers. The names themselves connote the nature of the transition. Formerly a trade association, it has become a mechanism by which the whole industry will be vitalized. A mere change of title would have accomplished nothing, but that was merely a gesture. Behind the gesture was a force—the personality of Thomas E. Wilson—and to make this force effective, the co-operative enthusiasm of the whole industry was enlisted. And so the idea has been made a great constructive factor in a progress which, though it is only beginning to make itself felt, has already become significant and notable.

Origin of the Plan

About 2 years ago Mr. Wilson, then president of the Institute, submitted a plan for the further enlarging of the scope of the Institute's work under the title of "The Future of the Institution of American Meat Packers." This plan and its realization are of such significance as to deserve our attention. We quote from the report:

"In my opinion, the Institute ultimately should become an organization which shall be a combined *trade association, industrial museum, research institute and educational institution.*

"As an educational institution, it should do at least three things:

"Provide broad but specialized collegiate education for young men intending to enter the packing industry.

"Furnish special training to sub-executives.

"Conduct a continuation school for plant employees and junior office help.

"As a research institution, it should:

"Develop and systematize scientific and practical data for the service of the whole industry.

"Carry on agreed researches into new scientific and practical problems common to all packers.

"Conduct experiments on the extension of products and reclamation of materials.

"Collate and disseminate information concerning discoveries and developments having relation to the packing industry.

"Conduct merchandising surveys and commercial research work.

"Discover waste and means of eliminating it.

"Test materials and equipment offered to the industry.

"As a trade association, it should continue to do what the Institute is now doing in this direction.

"As an industrial museum, it should provide space for permanent exhibits of models showing modern packing house operations, specimens and processes; and it should rent out space for exhibits of materials of industrial value, and for a permanent exhibit of packing house machinery and supplies—a sort of scientific museum and centralized market place, a gigantic permanent show window, conveniently located (being at Chicago), where packers from all parts of the country may come and view samples before making purchases and installations."

Partial Realization

In the past 2 years the educational and research part of the plan has become an organization—the Institute of Meat Packing—operated jointly by the University of Chicago and the Institute of American Meat Packers. The joint administrative committee consists of eleven men, seven from the University of Chicago and four from the Institute of American Meat Packers, as follows:

Representing the University of Chicago: James Hayden Tufts, dean of faculties, vice-president, the University of Chicago; Leon Carroll Marshall, professor and chairman of the department of political economy; William Homer Spencer, professor of business law and dean of the school of commerce and administration; Emery Thomas Filbey, dean of university college, director, Institute of Meat Packing; Hervey Foster Mallory, secretary of the correspondence-study department; Julius Stieglitz, professor and chairman of the department of chemistry; Charles Carlyle Colby, associate professor of geography.

Representing the Institute of American Meat Packers: Thomas E. Wilson, chairman of the Institute plan commission; Charles E. Herrick, president, Institute of American Meat Packers; Oscar G. Mayer, chairman of the committee on educational plans, Institute

John P. Harris
Director, Bureau of Practical Research

Thomas E. Wilson
President, Wilson & Co., whose energy and vision were in large measure responsible for the splendid breadth of activity of the Institute of American Meat Packers

W. Lee Lewis
Director, Bureau of Scientific Research

plan commission; William Whitfield Woods, vice-president in charge of the department of education and research.

The Institute of Meat Packing

Educational Program

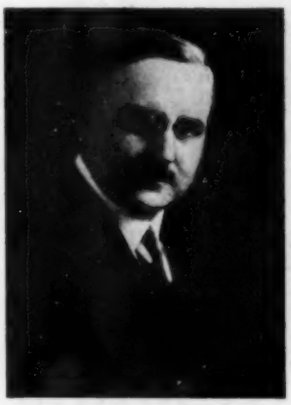
The educational program is comprehensive and interesting. Three general types of work are offered. The first is evening instruction in Chicago for experienced men now employed in the industry. Students are drawn from twelve of the packing plants in the Chicago district and they are offered courses in economics, science in the packing industry, operating, superintendency, marketing and finance.

One of the major problems presented in connection with the development of such courses for practical men in the industry grows out of the fact that suitable text material is not available in many of the subjects of instruction. Because of this difficulty it is necessary to carry out a large amount of research work in connection with each course. Such researches, coupled with study and discussion in evening classes, have already resulted in the bringing together of a large amount of very important text material. The second type is the correspondence study courses. They are offered for packing house employees away from Chicago and for others who do not find it convenient to attend the evening classes. These courses are of college grade and present essentially the same material as that used for evening instruction in Chicago. This work was started on Feb. 1, with four courses, including economics, accounting, science, and superintendency. Additional courses will be offered during the year.

The third type of work is extremely interesting. It consists of a 4-year program of study which begins on Oct. 1, 1924, and is intended for young men who desire to go forward with a 4-year college course before entering the industry. The first 2 years will be given to basic college training in such subjects as economics, chemistry, physics, geography and English. The third year will afford an opportunity for concentration in the field of special interest. The fourth year will provide very definitely for special training preparatory to employment in some part of the industry.

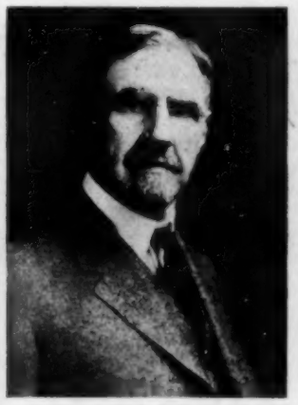
Results Are Certain

This is the method by which the educational plans committee of the Institute of American Meat Packers under the able leadership of Oscar G. Mayer intends to spread the leaven of both broad and specialized training throughout the industry. It is an effort that is bound to succeed and the benefit to the industry will be far greater than the small part that is capable of translation into dollars and cents. Many advantages will be apparent in their derivation from this infusion of new blood, but the unseen advantages will be of even greater service—advantages that can be better described by psychological than by any other word. The spirit of freemasonry that is encouraged by common experiences of background, of edu-



R. F. Eagle
Chairman, Committee on Practical Research

Oscar G. Mayer
Chairman, Committee on Educational Plans



Charles E. Herrick
President, Institute of American Meat Packers

Emery Filbey
Dean of the College, University of Chicago

cation and of special training will inevitably produce the same results that it has in the great mining industries of this country.

Program of Scientific Research

This great program of education is being supplemented by an equally comprehensive research program in the fields of both science and technology. To accomplish these results two bureaus have been established, each working in co-operation with a committee of the Institute. Dr. W. Lee Lewis has undertaken the directorship of the Bureau of Scientific Research and has the co-operation of a committee under the chairmanship of Arthur Lowenstein, supported by L. M. Tolman, W. P. Richardson, J. J. Vollertsen, H. Roeling, P. Rudnick and Millard Langfeld.

The first problem undertaken by the bureau is being studied under the Arthur Lowenstein Fellowship at the University of Chicago under the direction of Prof. E. O. Jordan and Dr. Norton. Allan Rieth has been selected to carry out the investigation that deals with the cause of the souring of joints, especially hams, and the means of preventing the losses from this cause.

The second problem has to do with the better utilization of blood, a large byproduct of the industry and one that is not being turned to the best account. The work will be carried out by Dr. Richard S. Vose at the Mellon Institute with the co-operation of a group of committee members.

Three other important efforts are being undertaken by this bureau. It is endeavoring to collect all the information there is on the problems of the industry and the extent to which they have been solved. The two other efforts are co-operative in nature, one with the Tanners Council and the other on the subject of corrosion of metals with brine solutions with manufacturers and users of refrigerating machinery.

Program of Practical Research

The Bureau of Practical Research has been placed under the direction of J. P. Harris, with the co-operation of a strong committee of the leading operating men in the industry. R. F. Eagle, of Wilson & Co., is chairman and the following men have made up the personnel: M. D. Harding, vice-chairman, Armour & Co., Chicago; A. W. Cushman, Allied Packers, Inc., Chicago; R. W. Trotter, Boyd, Lunham & Co., Chicago; R. E. Yocum, Cudahy Packing Co., Chicago; George Voltz, Jacob Dold Packing Co., Buffalo, N. Y.; W. H. Allerdice, Indianapolis Abattoir Co., Indianapolis, Ind.; John Roberton, Miller & Hart, Chicago; George M. Foster, John Morrell & Co., Ottumwa, Iowa; W. B. Farris, Armour & Co., Chicago; F. J. Gardner, Swift & Co., Chicago; Donald MacKenzie, Swift & Co., Chicago; J. H. Agnew, Wilson & Co., Chicago; S. C. Frazee, Wilson & Co., Chicago.

Membership on the committee is not a nominal honor, but entails a great deal of thoughtful work. The committee is in reality an advisory group of consultants on operating problems and their work has been fruitful in many lines.

They have solved individual operating and mechanical problems of every description, such as the elimination of mold in cured meats, high free fatty acids in rendered fats, etc., and have assisted in getting the fullest yields of by-products and in doing away with offensive odors in operating departments. These very busy men have contributed their time and services to aid the industry and have answered all questions in a free and unrestrained manner.

The bureau in addition has accumulated a very complete library of catalogs and descriptions of machinery, equipment and supplies of interest to the industry and it has assisted members of the Institute in purchasing intelligently and economically.

Again the bureau has made a start toward the standardization of machinery that is used by the meat packing industry. It is the ultimate aim to have complete uniformity and interchangeability of parts and to stimulate the manufacture of labor-saving devices and of new and improved machinery.

Carts Bringing Quebracho Logs Into Villa Rica, Paraguay, for Shipment to Buenos Aires

Latin America's Greatest Contribution to the Tanning Industry

Quebracho, in General Use for Less Than 50 Years, Ranks Among the World's Most Important Vegetable Tanning Materials

By Otto Wilson
Former Chief, Latin-American Division, Department of Commerce

CHIEF of all Latin-American contributions to the tanning industry is of course the famous quebracho. It now occupies a place in the front rank of the tanning materials of the world, although it has been known as a valuable tanning agent only about 60 years and has been widely used for only about half that time. Its tanning properties had long been known to the natives, but they appear to have been discovered by the commercial world only in the middle of the last century. It made its bow to the public of Europe at the Paris Exposition in 1867. Its value was recognized and in a few years its use had spread to the tanneries of France, Switzerland and Germany, although it was not until the late '80s and early '90s that its importation into Europe began to take on large proportions. Exports of logs from Argentina first passed the $1,000,000 mark in 1891, and since then have seldom fallen below that level, although since 1895 there has been a steadily growing trade in the extract, the first factory for making it having been built in Puerto Galileo, Paraguay, in 1889. Argentine exports of logs reached their peak in 1914, when over $9,000,000 worth was shipped, and of extract in 1916, when the trade totaled more than $19,000,000. Although the wood is one of the heaviest known, the shipment of logs remains considerable, as shown in Table I, which shows exports from Argentina of both logs and extract since 1901.

England was formerly the chief importer of quebracho, but since the war the United States has taken first place. German capitalists and technical men have been deeply interested in quebracho since it first appeared above the horizon, but when the war came in 1914 Germany surrendered her hold on the industry and trade to England, whose interests are dominant today. The chief producing company in the quebracho field is English. It is the Forestal Land, Timber & Railways Co., Ltd., operating with a capital of £5,436,799, owning outright 4,800,000 acres of land and leasing a further 630,000 acres. It dominates the whole industry in Argentina and Paraguay. In 1916 it associated with itself a number of smaller companies, for which it acted as selling agent and in this manner exercised a certain control over the whole market for a time. The agreement lapsed after a year or two, was renewed in 1919 and was again discontinued in 1922. The commanding position of this concern and the control over prices which it exercises are of direct interest to the American tanning industry, which now provides the quebracho interests with their greatest market.

Table I—Exports of Quebracho From Argentina

Year	Logs, Metric Tons	Extract, Metric Tons	Year	Logs, Metric Tons	Extract, Metric Tons
1901	198,920	4,310	1916	101,711	120,010
1906	230,100	30,839	1917	108,945	100,904
1911	438,219	68,431	1918	8,046	124,710
1912	279,342	74,910	1919	51,264	172,588
1913	383,964	79,684	1920	56,582	122,837
1914	291,942	80,153	1921	30,857	120,100
1915	209,679	100,213	1922	124,822	167,845

Quebracho Now Our Chief Tanning Material

In the United States the advance in the use of quebracho has grown steadily until now it is our chief tanning agent, surpassing even chestnut. Of the total amount of tanning extracts, both liquid and solid, used in this country last year quebracho made up 47.1 per cent, as compared with 46.5 per cent for chestnut extract and 2.5 per cent for oak. Including all kinds of tanning materials, barks, leaves, etc., as well as extracts, the proportion of quebracho extract was 29.1 per cent, chestnut 28.7 per cent and oak bark and extract 14.1 per cent. Expressed in bark tons, the 1922 consumption of quebracho extract was equivalent to 345,619 tons out of a total for all imported materials of 469,183 tons, or

73.6 per cent. The actual quebracho imports in the calendar year 1922 amounted to 54,085 tons of wood, valued at $626,123, and 100,614,587 lb. of extract, valued at $4,190,908. The demand during 1923 was even larger, and in the first 9 months 99,190,770 lb. of extract was imported, almost as much as during the whole of 1922, although because of lower prices the total value, $3,409,-265, was less than for the corresponding period in 1922. The steady consumption of wood and extract by American tanneries since 1907 (the first year in which the import statistics give separate figures for them) is shown in Table II.

Table II—Imports of Quebracho Into United States

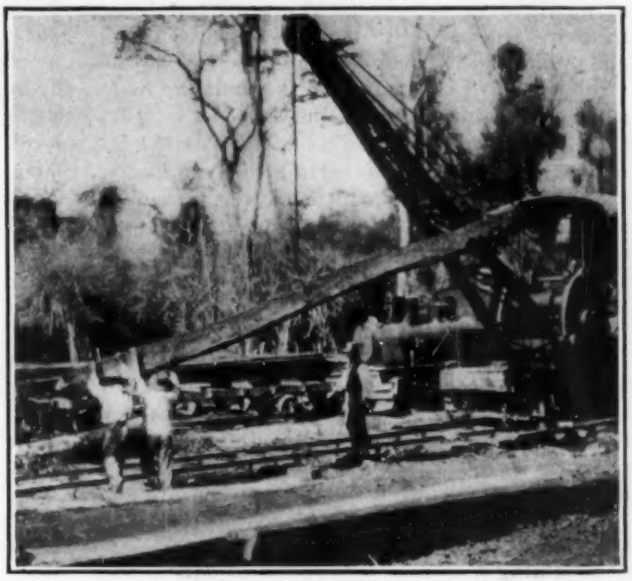
Fiscal Year	Quebracho Wood Long Tons	Value	Quebracho Extract Pounds	Value
1907	66,810	$840,779	79,033,584	$2,319,785
1914	73,911	899,603	93,329,087	2,543,302
1915	54,955	753,981	120,450,283	3,676,749
1916	106,864	1,598,465	81,501,952	5,432,468
1917	73,367	1,274,660	59,808,734	5,198,904
Calendar year				
1918	22,802	357,190	131,109,739	5,698,618
1919	3,962	53,679	144,496,648	6,902,947
1920	56,064	850,284	108,897,440	6,700,216
1921	6,547	108,119	144,398,673	6,448,910
1922	54,085	626,123	100,614,587	4,190,908

Imported quebracho extract is distributed in this country by a branch of the English company mentioned, with offices in New York, and by others. There are, all told, about a dozen companies in the United States that turn out quebracho extract for use by tanners. According to one authority all but one of these now confine themselves to the manufacture of the liquid extract by dissolving the imported powder. One Brooklyn factory makes the liquid extract direct from logs brought from South America. This extract, made direct from the wood, is said to have certain advantages over that made by dissolving the solid extract, which accounts for the continued importation of the heavy logs of quebracho

Quebracho Operations, Parana River Near Concepcion, Paraguay

over the 6,000 miles and more of ocean highway from Buenos Aires. The liquid made from the wood is said to be lighter in color, with less "reds" and more non-tannin, and commands a better price. But the high freight costs and the necessity for keeping a staff of highly skilled employees are said to increase the cost of manufacture to a point where competition with the Argentine and Paraguayan industry is difficult. The facts set forth in a report of the United States Tariff Commission indicated the desirability of protection for the domestic industry and Congress placed a duty on the extract, but left the wood on the free list.

Prices in the last 10 years have fluctuated widely, partly because of the changes in control of the industry in South America and partly because of the war. It is said that the bed-rock cost of production in Paraguayan factories is close to $60 a ton. This price has occasionally been reached in the downward swings of the market, sometimes resulting in the closing down of the factories entirely. On the other hand, syndicate control before the war at times pushed the price to



Loading Quebracho Logs Onto Cars

between $70 and $80 a ton. One of the curious features of the pre-war trade was that Germany apparently could import the logs from the River Plate, manufacture the extract and quote prices for the extract at German ports that were lower than the actual cost of production of extract on the ground in Paraguay. This competition, however, was ended by the war, which also sent prices to the highest point they ever reached, $236.42, in 1916. In October, 1923, London quotations at English ports were £19 to £19 10s., equivalent at normal exchange to $92 to $95.

As compared with other tannins, quebracho has several advantages. Quoting the report of the Tariff Commission on "Tanning Materials and Natural Dyes": "Quebracho extracts are marketed as a black brittle solid of 65 per cent tannin content (untreated, and chemically treated to increase solubility) and as a liquid extract of 35 per cent and 25 per cent tannin content, respectively. The solid extract is shipped in bags and casks, while the liquid is shipped in barrels and tank cars. It acts quickly and thoroughly, giving a leather of good strength, toughness and firm feel, and produces a more mellow leather than bark tannage, forming a good grain in a shorter time. Quebracho is seldom used alone, as best results are given by combining it with other tannages, as chestnut, oak bark, hemlock or mangrove. The combination with chestnut is of great importance and extensively used. One reason for using quebracho in combination with extracts is the low content of fermentable non-tannin matter, which produces acid on fermentation. The absence of these fermentable

non-tannins makes quebracho a 'sweet' or 'non-plumping' tannage. It has a greater percentage of tannin to a given density than any other important tannage. It is used as a substitute for the more expensive gambier and produces a fine-grain soft texture, and the necessary pliability for the preparation of patent leather. It is used for tanning sole, upper, heavy leathers, as strapping and belting, calf and sheepskins."

According to Norton, quebracho also gives excellent results when combined with oak. It differs from hemlock and oak in that when used alone it will not produce the best grades of leather. Used with alum and salt, it yields a light yellow leather. Regarding the use of alum, H. R. Procter in his "Principles of Leather Manufacture" says: "With many red-colored tanning materials, such as hemlock and quebracho, the addition of small quantities of alum to the tanning liquor effects considerable improvement in color, not only by precipitating a part of the difficultly soluble 'reds' but by developing the yellow color of certain coloring matters (quercetin, myricetin, etc.) which may be present. Such an addition does no harm in the case of soft leathers, but would probably be injurious in a sole leather tannage,"

The chief advantages of quebracho over other tannins are due to its cheapness and the promptness with which it acts.

As it comes from the forest the wood of the true quebracho tree is about one-fourth tannin. The bark contains 6 to 8 per cent tannin and the white outer layer of sapwood, 1 to 3 in. thick, contains 3 to 4 per cent, which is as much as that contained, on the average, by oak wood. But both bark and sapwood are stripped off in the forest and only the dark-red heartwood is shipped. This contains proportions of tannin which various tests have shown to run from 20 to 28 per cent. Most of the wood is worked up in factories in Paraguay and Argentina, where the logs are chipped by machines and the tannin extracted by boiling. The extract contains about 65 per cent tannin. Much of it is sold under a guarantee of 63 to 67 per cent and this standard is said to be well maintained. (See "Tanning Materials," by Arthur Harvey.) Norton gives the following analysis of a typical sample of quebracho extract: Tannin, soluble, 64.5 per cent; tannin, insoluble, 8.0 per cent; non-tannins, 7.5 per cent. Comparative analyses of a liquid extract and a paste showed:

Constituents	Extract Per Cent	Paste Per Cent
Water	43.6	18.7
Tannin	48.3	70.4
Non-tannins	3.8	7.9
Ash	1.6	1.5
Insoluble	2.6	1.6
Carbohydrates	1.5	1.8
Carbohydrate percentage referred to tannin.	3.1	2.6

The exact chemical nature of quebracho tannin is still to be determined. It is usually considered a pure catechol tannin, but analyses by W. Moeller (*Collegium*, No. 599, pp. 106-9, 1920) indicate that the tannin of the sapwood may belong to the pyrogallol class. An abstract of this work will be found in the *Journal* of the American Leather Chemists Association, December, 1920, p. 678. The September, 1921, issue of this same publication contains an abstract of later experiments by L. Jablonski and H. Einbeck.

A most important discovery, and one to which the development of the South American industry owes much, was made by two Italian chemists, Lepetit and Tagliani. Quebracho contains a considerable quantity of difficultly soluble tannin, and when hot aqueous solutions cool, this is precipitated, making the liquid turbid. "Lepetit and Tagliani," according to a paper by Klepstein referred to in Harvey's book, "after long experimenting discovered that the sulphurous salts of the alkali metals such as sodium sulphite, bisulphite or hydrosulphite would so perfectly dissolve the reds of quebracho extract as to keep them soluble not only in cold water but in the acid liquor of the tannin vat. They found also that these salts so acted on the soluble tannins of quebracho extract as to prevent their precipitation in sour liquors; in short, they found that by treating quebracho extract with sodium bisulphite or other sulphites under suitable conditions, all loss of soluble tannins was prevented and all insoluble or difficultly soluble tannins were made available by solution.

Typical Quebracho Log

The application of this discovery to quebracho extract eliminated all of its objectionable properties; made its use possible under all tanning conditions and in combination with the sour liquors of all other tanning extracts, thereby adding fully 25 per cent to its value by saving and utilizing the tannins which had previously been precipitated and thrown away. In fact, it is not going too far to characterize this discovery as one of the most important ever made affecting the leather industry."

This discovery led to the taking out of two English patents in 1898 by Lepetit, Dolffus and Gansser, Nos. 8582, 1896 and 2603. By the first of these patents, as noted by Procter, "quebracho and other extracts are rendered soluble by heating in closed vessels with bisulphites, sulphites, sulphides or even caustic alkalis, and many 'soluble quebracho extracts' made on this principle are now on the market."

Another method of solubilizing, which according to Harvey is more suitable for the treatment of extract and has been patented in England and the United States, is by treating with aluminum sulphate and then with sodium bisulphite.

(Divi-divi and the less developed tannin resources of Latin America will be considered in a subsequent article.)

How Structure and Surface Affect

Combustibility of Coke

In This, the Last of Three Articles, the Author Tells the Maker and User of Metallurgical Coke to What Extent Its Utility as a Fuel Can Be Determined From Appearance

By A. Thau

Superintendent Deuben Coke Plant, Halle, Germany

IT WAS formerly the custom of consumers of metallurgical coke to value this product according to chemical analysis, crushing strength, friability, porosity, specific gravity and other similar qualities. Of late, more scientific control of blast-furnace and other metallurgical operations has brought coke combustibility to the fore as a quality of paramount importance. Although there is as yet no standard test available for determining the relative combustibility of coke, extensive research by eminent experts has thrown much light on the subject. In this light the writer will briefly discuss combustibility of coke, using for illustration the points made in his two preceding papers (*Chem. & Met.*, Feb. 11, 1924, pp. 222 to 227, and Feb. 25, 1924, pp. 306 to 310). The results of the excellent research carried out by Beilby on the structure of coke and the work done by Sutcliffe and Evans, on the reactivity of the coke structure, will be considered as known, so that the following remarks may be taken as a deduction from their results:

There is no doubt that the results of these researches compel coke consumers to revise many views formerly held. A common error made is the assumption that combustibility increases with porosity. That this is not so may be illustrated with sponge coke, such as shown in Fig. 1. This coke, with its exceptionally large pore area, is so light that it floats in water, yet on an ordinary grate it behaves like firebrick, glowing on the side near the fire without being consumed, and remaining black and unaffected on the other parts.

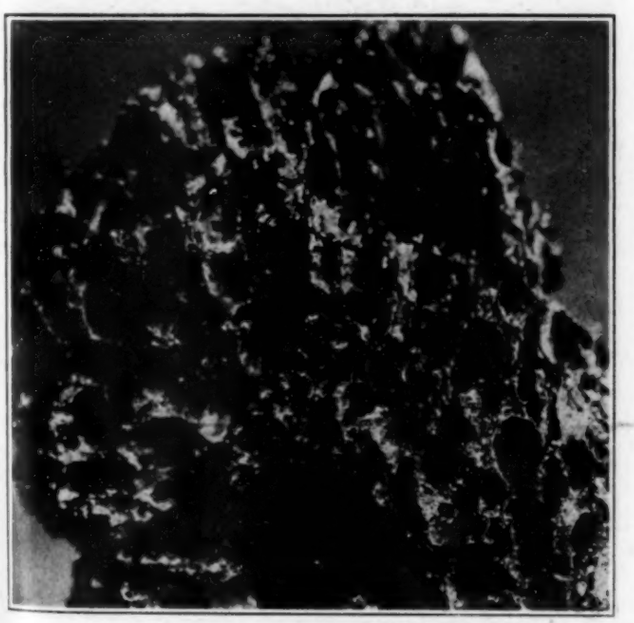


Fig. 1—Specimen of Sponge Coke

Even experts disagree as to the main causes of slow or rapid coke combustion. One group looks for the reason in coke structure, while another maintains that combustibility increases with the amount of volatile matter in the coke. Both these views can be easily reconciled, as will be pointed out below. In ordinary coking practice it is true within limits that the denser of two cokes is the less combustible. For example, note the furnace coke at the right side of Fig. 2 and the foundry coke on the right of Fig. 3. The furnace coke, the more porous, is the more combustible. Now, compare the two cokes of Fig. 2 and the two of Fig. 3. In each case the coke on the left, though much denser, proved to have by far the greater combustibility. In Fig. 4 the coke on the left, which is the same as that on the left of Figs. 2 and 3, is more easily combustible than that on the right, which is denser, without a cell structure and is a conglomerate that can hardly be regarded as coke. Those who believe that volatile content governs combustibility will see their view accidentally confirmed in Fig. 3.

Influence of Surface on Combustibility

If the coke in Fig. 1 is practically non-combustible with an excess of cell space and that on the right of Fig. 4 is the same with no cell space, it tends to show that surface conditions rather than structure is the governing factor in relative combustibility. The solution of these somewhat contradictory facts can be found in the premise that combustibility is due to a multitude of microscopically small cells. From this it may be deduced that, as far as the reactivity of coke with oxygen is concerned, those cells that are visible to the naked eye have no appreciable influence upon the combustibility. If from the piece in Fig. 1 a cell wall is broken out and studied under the microscope very few if any small cells will be seen on the surface. This is because when the thick streams of tar vapor forced their way through this coal, forming large cells, some tar condensed and blocked the cells which in the moment of being heated had already appeared.

A high reactivity of small cells is assured only if these cells remain perfectly open. With the large surface provided by many small cells, there is at the same time a tendency to blocking these cells partly or completely with graphite. And with a coal high in ash a large amount of foreign matter is imbedded in the coke

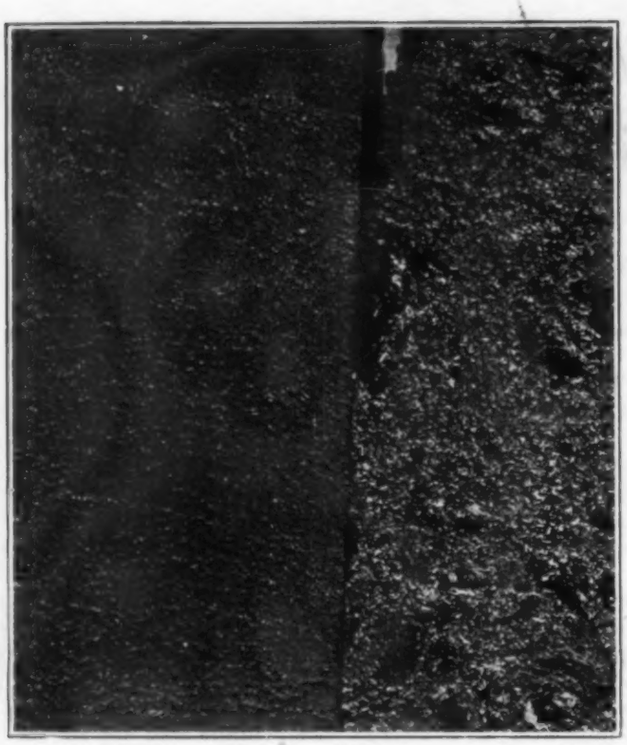


Fig. 2—Furnace Coke (Right) Compound With Coke From Flotated Coal (Left)

structure—matter naturally devoid of small pores. This fact substantiates the belief that dense coke is not easily combustible. But in judging the reactivity of coke by its density the purity of the coal must be considered.

The coke on the right side in Fig. 3 illustrates this. A large number of shale splints are seen imbedded therein. If we could measure the total area of these pieces of shale in relation to the surface covered by open cell structure, a considerable area which is not reactive would have to be written off as non-combustible. If we consider the coke on the left of Fig. 3, we notice a decidedly denser structure than that shown by the piece on the right. But the absence of incombustible matter is apparent, and this accounts for its greater combustibility in spite of its dense structure. From the above it may be deduced that ash content in coal plays a much greater part in reducing combustibility than is generally believed.

Influence of Graphite on Reaction

But even a properly formed dense cell structure may be rendered inactive by a cover of vitreous carbon. This is well shown by the surface of the piece of beehive coke, illustrated in Fig. 5. Here the whole cellular structure is protected against oxidation by a thick glaze of carbon. This does not mean that beehive coke is less reactive than byproduct, as only those surfaces which face a crevice in the change are so glazed. I have not so far been able to make extensive tests in this respect, but I have been able to ascertain that the coke surface glazed with vitreous carbon is not attacked easily by oxygen, and such coke is not easily combustible if attacked from the glazed side only.

Though not quite so thickly covered, the surface of the coke in Fig. 6 is also protected by a vitreous carbon glaze. It was for this reason not easily combustible. The piece on the right of Fig. 4 lacks reactivity due to complete absence of cell structure. In this case the cells have not been obstructed, but their formation has been prevented by ash particles surrounding the coal particles. If we look closely at the cell space of the coke on the right of Fig. 2, a normal but somewhat porous blast-furnace coke, we see a large number of open cells the sides of which are covered with deposits of vitreous carbon as indicated by the light spots. Since the large cells are, as already mentioned, of no value in affecting the combustion, and as the minute cells on the walls of the larger cells are obstructed, the lower combustibility of this specimen is explained.

The fact that low-temperature coke should be exceedingly combustible sounds rather like a contradiction of the foregoing remarks. As this so-called semi-coke contains about 8 per cent volatile matter, it seems to strengthen the theory of those who claim the reactivity to be dependent on the volatile content of the coke. Such semi-coke has not sufficient crushing strength and the friability of its surface is far too great to permit its use in blast furnace or cupola. During combustion it does not exactly soften—at least it should not—but under the influence of heat the gas contained in its cell walls is driven out. As these cell walls are quite free from vitreous carbon deposits, an additional number of minute cells is formed all the time combustion proceeds and the area of reactivity is greatly enlarged. To assume that the escaping gas accelerates the combustion is to make a conclusion without foundation. The gas will lower the ignition temperature of the coke considerably; but, since it consumes oxygen which might otherwise react upon the coke surface, it cannot be maintained that the gas itself promotes combustion of coke.

How Volatiles Affect Coke Combustibility

The low-temperature coke being useless for blast furnaces, higher temperatures must be applied. Supporters of the theory that combustibility varies with

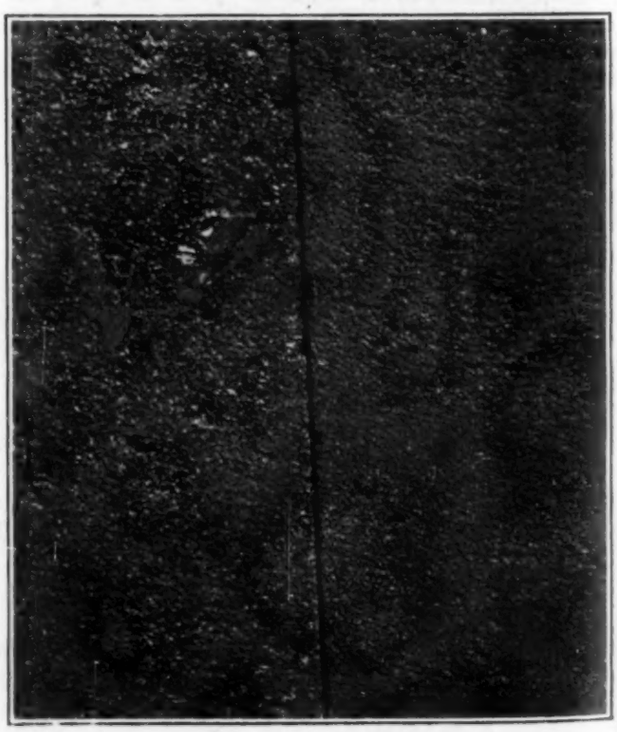


Fig. 3—Foundry Coke (Right) Compared With Coke From Flotated Coal (Left)

volatile content demand a coking temperature which exceeds that of a low-temperature retort, but which should be lower than is generally used in modern coke ovens, in order to retain a certain amount of volatile matter in the coke. They demand, in addition, that coke should be pushed before the volatile is entirely driven off, and on no account remain in the oven after carbonization is completed. For the same reason the supporters of the superiority of beehive coke claim that its combustibility is greater than that of byproduct coke, because no more heat is applied in the beehive oven after carbonization is completed, the heat being cut off automatically as soon as no more gas is given off by the charge and burned on top. It has never, however, been proved that beehive coke is more combustible than byproduct.

Discharging coke before carbonization is completed has little effect on the volatile content. As the coke forms from the oven walls toward the center of the charge, it is evident that it cannot contain any appreciable amount of volatile matter, as the temperature applied must be high enough to overcome the heat resistance of the charge in transmitting heat toward the center. Thus only the central zone of the charge can still retain much volatile and, if pushed before this has been driven off, the ends of the coke pieces along the central seam will be more friable. It would be going too far, however, to condemn such carbonizing practice as futile. Its favorable effect, however, lies in a prevention of overheating the charge. Such overheating, heating after absorption and transmission of heat has ceased, would result in the deposit of carbon glaze on the surface and a consequent blocking of the open cell area, thus decreasing combustibility. In this way the two theories, that combustibility depends on volatile content on the one hand and on surface condition on the other, can well be reconciled.

The generally prevalent view that coke should have a high silvery gloss is, then, if combustibility is a

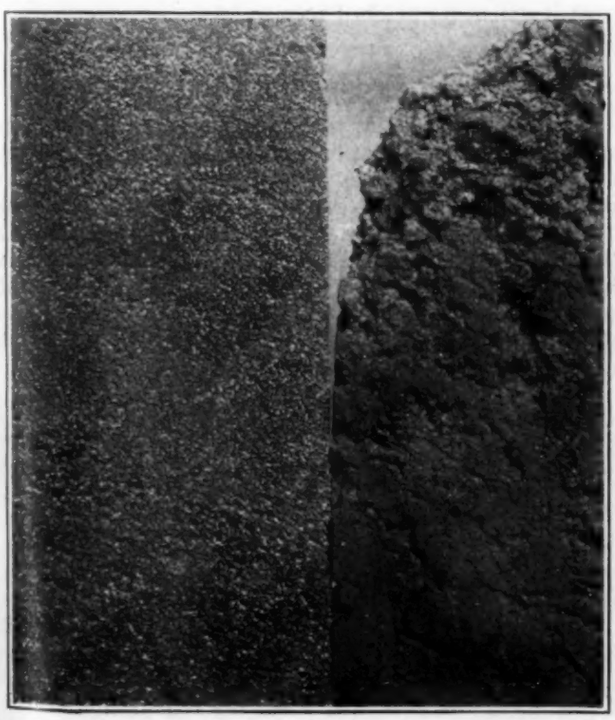


Fig. 4—Coke From Washery Slime (Right) Compared With Coke From Flotated Coal (Left)

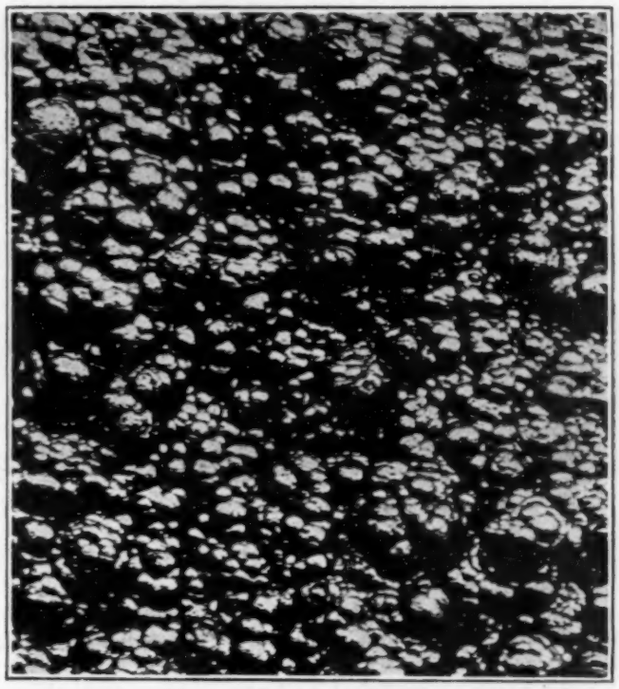


Fig. 5—Specimen of Beehive Coke With Typical Surface

desideratum, erroneous. The silvery appearance may be considered favorable in that it indicates a low percentage of moisture; but beyond that it is a distinct disadvantage, particularly in blast-furnace coke. Furthermore, a coke cannot be too dense, provided the coal from which it is made is free from impurities and that it has an open cell structure, even though this latter fact cannot be recognized with the naked eye.

The failure to obtain a fairly hard, coherent coke in low-temperature carbonization must, to a great extent, be attributed to the absence of carbon deposits, for in low-temperature carbonization the temperature should be so low that decomposition of hydrocarbons on a large scale does not occur. In consequence the low-temperature coke looks black, its close cell structure is hardly recognizable; but its combustibility is better than that of any other solid fuel—even charcoal. Should it be possible to produce such a coke of sufficient crushing strength and small friability to make it usable for metallurgical purposes, it would be vastly superior to the best byproduct oven or high-temperature coke known. Efforts to do so are not very promising as long as usual coking practice is followed, since the hardness of the coke structure is dependent entirely upon deposits of carbon. Naturally, there is a great difference between a carbon deposit just sufficient to harden the cell walls to reduce the friability and a carbon glaze obstructing the cell space completely, and the problem here is to find a happy medium.

Numerous attempts have been made to convert low-temperature coke into a metallurgical fuel, first by the Carbocoal process in the United States. The carbon deposit on the outer surfaces of Carbocoal briquets is very thin, and a glaze can hardly be noted, so that this fuel compares favorably with the best coke as regards combustibility. Whether its price can stand the competition of coke in blast-furnace practice I have been unable to ascertain.

The most remarkable achievements in this connection are due to Sutcliffe and Evans of London (*Chem. &*

Fig. 6—Specimen of Byproduct Coke With Vitreous Surface

Met., 1923, vol. 29, No. 10, p. 401) with their so-called pure briquet process. The coal is washed, dried, ground to almost colloidal fineness and then pressed into small briquets without a binder. These briquets are carbonized in a retort by internal heating with superheated gases or steam at so low a temperature that a decomposition of hydrocarbons and a deposition of carbon upon the briquet surfaces or in their structure in the form of graphite is entirely avoided.

This fuel has a very good combustibility, exceeding that of the best coke by far and approaching that of low-temperature coke. But the structure, in fracture, does not appear to have an open texture at all. It looks almost like black granite and the largest of its cells can be discovered only with a strong magnifying glass. Its structure consists of a great number of microscopical cells which assure high reactivity with oxygen. I have attempted to photograph a ground surface of this fuel in order to include it in the illustrations of this paper. But nothing could be obtained but a picture of a circular black surface, no cellular details being visible.

This example shows in particular that, without knowing the chemical constitution of a fuel, it is quite impossible to judge the quality by the density of the structure. Sutcliffe and Evans have shown that a fuel of proper composition cannot be too dense as long as the coal is sufficiently pure for a briquet produced as theirs is, and must certainly be denser than any other fuel. If it is assumed that each of the almost colloidal particles of coal that go to make up such a briquet will form only one cell for the escape of the gas which it contains during carbonization, the multitude of cells present can be imagined, and their reactivity understood. Naturally, the slightest graphite deposit would easily obstruct the cell structure, and render such a fuel almost incombustible. There is not the slightest doubt that the developments in this direction will yield results which will compel us further to change our methods of judging coke and similar fuels by their appearance alone.

To Determine Paper-Making Fibers

The Bureau of Standards is making a compilation of data relating to the size of plant fibers suitable for the manufacture of paper. There is a great deal of information of this nature scattered through the literature, and it is believed that if gathered together in convenient form it will be of value.

French Artificial Silk Industry Growing

Lyon, France, has long been said "to make the market" among silk buyers. Traditionally France might have been expected to hold off from the artificial silk industry. Actually the silk industry of France recognizes that production at home and in the world markets is far below the demand. The fact is also recognized by the competing artificial silk manufacturers, who have expanded greatly since the war.

The "viscose" artificial variety of silk seems to be more in demand than the "Chardonnet" variety for the moment. The industry has been largely centered in the south and mid-south of France, at Albi in the foothills of the Pyrenees, at Besançon in the valley of the Doubs near the Swiss frontier, at Chavanoz in the Isère in the foothills of the Alps, in the lower valley of the Rhone at Vals, La Voult-sur-Rhone. At Arques-la-Bataille in Normandy a mill has recently been put into operation and a new mill has been erected at Casteres in the Tarn in southwestern France. The French Société Borvisk has recently been formed with a capital of 10,000,000 francs for the manufacture of artificial silk and all cellulose products, and the now celebrated Usines du Rhone has lately developed its artificial silk plant.

There is a pronounced movement in favor of the further development of the industry in the north of France, inspired perhaps by the phenomenal success of the important Tubize plant just across the border in Belgium. In the departments of the Nord and the Pas-de-Calais in the north, where almost all textile industries are represented, the artificial silk industry has been neglected or ignored. The net, embroidery and lace makers of Caudry, Calais and Saint Quentin are following the fashion and making use of artificial silk fiber in their output, and it is natural that they, in association with others, or that others coming in from outside should seek to manufacture the semi-finished product near the market, where other plants will take it over and turn it out in its finished forms.

Paper Production for 1923

Figures compiled by the American Paper and Pulp Association in co-operation with affiliated organizations of paper manufacturers indicate that the total production of paper of all grades in the United States in 1923 was approximately 7,200,000 tons. This total is larger than the production of any other year in the history of the industry, except 1920, when the total was 7,334,614 tons. It is somewhat larger than the production of 1922, which was 7,017,800 tons, and is distributed among the chief grades as follows:

Grade	Tons	Grade	Tons
News print	1,506,204	Tissue	181,948
Book	1,078,783	Hanging	91,489
Board	2,251,079	Felts and building	410,693
Wrapping	1,002,905	All other	310,390
Fine	364,552		

These figures are estimates, being based on the incomplete figures provided by the mills that are cooperating with the various associations of the industry in the compilation of production statistics, and no more accurate figures will be available until the 1923 United States Census Reports are issued. Figures were compiled by the Federal Trade Commission during the first 5 months of the year, and when the commission ceased this compilation, the task was assumed by the American Paper and Pulp Association.

Making Lead-Lined Pipe

How Piping and Valves Are Produced So That They Possess Both the Chemical Resistivity of Lead and the Strength of Iron

Lead-lined pipe is made in more than one way and sold at more than one price. Sometimes the lining is of cast lead; sometimes it consists of an extended lead tube. The use to which the pipe is to be put determines the type that should be bought to insure satisfactory resistance to corrosion without a waste of money. It is hoped that the description of methods of manufacture presented here will assist in intelligent buying.

IT IS an interesting fact that when a problem arises that requires the consideration of a corrosion-resisting metal, the mind of the average present-day technologist turns first to recent developments along this line with hardly a thought for lead, the old standby that lined the sink in the laboratory where he was first introduced to a test tube. The volume of discussions, written and verbal, during recent years on the development of corrosion-resisting metals with mechanical strength or ability to resist the effect of high temperatures has had the result of deflecting the thought of the average engineer from the oldest and in some respects the most efficacious metal for use where resistance to corrosion is the primary consideration.

In many problems time will be saved if lead is considered first instead of at a later day when more noble

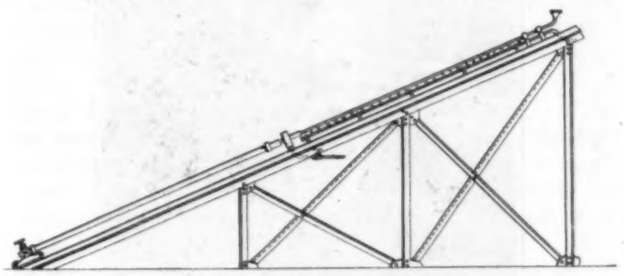


Fig. 1—Lining Machine
A diagrammatic elevation of the machine used for lining iron pipe with lead by the "amalgamation" process.

metals have failed or have proved too costly. Of course, there are many cases where the low melting point of lead and its lack of mechanical strength eliminates it at once from consideration, but in a situation where the temperature is not high and there is a possibility of backing up the acid resistant with steel or other reinforcement, it pays to investigate the use of lead.

The most widespread application of the combination of lead and steel in this way is, of course, the manufacture of lead-lined iron pipe. This product has been used for decades in competition with homogeneous pipes of lead, iron and brass for use with liquids of slight corrosive action, and in recent years it has become a very important part of the equipment of plants in the chemical industries for handling acids and similar destructive liquids.

The lining of iron pipe with lead is done by two different methods, and it is essential that the buyer of the pipe understand them if he would obtain satisfactory results from their use. The first and cheaper method produces a cast lead lining, while the second provides a more dense lining of extruded lead tubing. The cast lead lining is, of course, economical and should be used where the corrosive agent is a comparatively feeble one—impure water, for instance. The second method results in what is called a "tube-lined" pipe and the lead contains none of the impurities that are always to be found in cast lead, and furthermore, it is not porous in the slightest degree. Where strong acids or other corrosive chemicals are to be conducted, it pays to use this tube-lined pipe in spite of its higher cost, for these liquids seldom fail to take advantage of the presence of the smallest particle of impurity that may result in electrolytic action, starting a local corrosion that will soon progress through the wall of the pipe.

The Lining Process

The manufacture of the cast-lined pipe is an ingenious process. The iron pipe is first pickled and galvanized, for lead will not alloy directly with iron, but will combine very effectively with a zinc go-between. The combining of the metals in this way is responsible for the name "amalgamated," often used for this type of pipe. The galvanized pipe is now taken to the lining machine shown diagrammatically in Fig. 1, where it is laid along the lower part of the trough or ramp which is at about 30 deg. with the horizontal and twice as long as the pipe. Here it is clamped at its lower end in a vise that can be run up and down the slope, carrying the pipe with it. From the top of the incline a narrow feed pipe extends downward along the sloping runway. In the wall of this pipe near its lower end there is a hole, and projecting from the end is a long plug or mandrel of the same diameter as the opening that is desired in the finished lead-lined pipe. This is shown a little

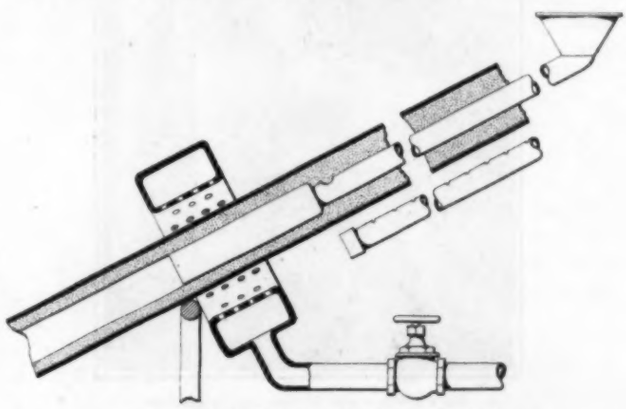


Fig. 2—Cross-Section of Lining Machine
Showing the introduction of the molten lead into the iron pipe, and the means whereby it is "frozen into place."

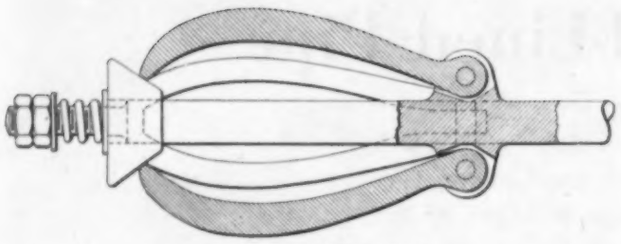


Fig. 3—The "Expander"
The four separate segments of this melon-shaped tool are forced apart by the cone and spring.

more clearly in the close-up, Fig. 2. The pipe to be lined is now pushed up the ramp. It meets the end of the feed pipe and runs on over it, sheathing it. A ladleful of the molten lead is now poured into the top end of the feed pipe and when this begins to run out of the lower end of the pipes, a circle of streams of water is played upon the outside of the iron pipe from the quenching ring, which is concentric with the mandrel at the end of the feed pipe and which is now also directly over the outside of the iron pipe at its lower end. The lead solidifies at once at this point and prevents more lead from escaping. The hot lead that is poured into the feed pipe now runs also into the annular space between the two pipes, where it is kept fluid by a series of gas burners distributed along the length of the pipe. And now, with the streams of water again playing on the pipe over the mandrel, the iron pipe is drawn slowly down the ramp. The space between the mandrel and the pipe is kept filled with hot lead from above and this solidifies in place as the pipe passes over the mandrel and through the quenching ring, leaving the pipe with a lead lining of accurate thickness. The centering of the feed pipe in the pipe being lined is provided for by the presence of small longitudinal lugs on the former.

As the starting and stopping of this process would otherwise leave irregularities in the lining, necessitating the cutting off of several inches of the pipe at each end, false ends about 8 in. long are generally screwed on to the pipe to be lined and taken off after the lining has been laid in.

Tin-lined pipe is produced in much the same manner, but the pipe to be lined is not galvanized. Instead, it is tinned by immersion in a bath of the molten metal before it goes to the lining machine. Cast tin being brittle, considerable care is required in the lining process to prevent the flaking of the lining as it leaves the cold end of the mandrel. Experience, however, has taught the correct speeds and temperatures so that the capable operator has little trouble in producing excellent results.

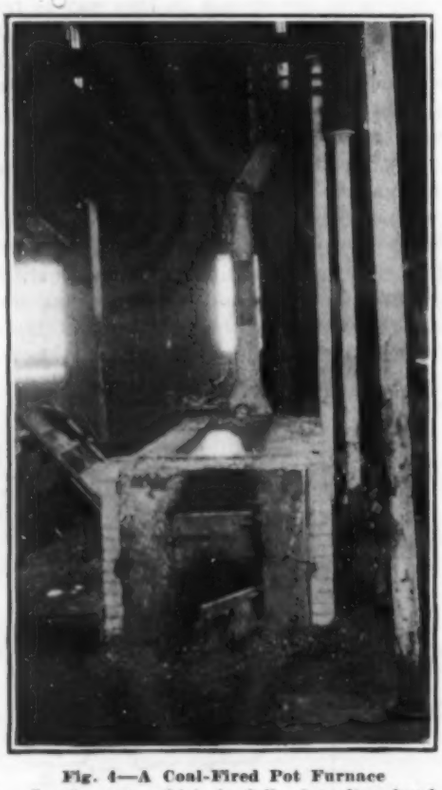


Fig. 4—A Coal-Fired Pot Furnace
In the pot, which is full of molten hard lead, are immersed the cored fittings which are to be lined.

Fig. 5—An 8-In. Valve
The lining in this valve is almost an inch thick and the valve consequently is as large as a regular 10-in. valve and as heavy as two of them.

Tin-lined pipe finds its most important application in the handling of liquids that are to enter into beverages or food products. The purpose of the lining is not so much to protect the pipe from corrosion as to protect the fluid from contamination. Tin-lined pipe is, of course, much cheaper than block tin pipe and many times as strong.

Making Tube-Lined Pipe

The manufacture of tube-lined pipe is a simple but comparatively slow and expensive process. While a lead tube can be used loosely inside an iron pipe, in most cases this is very unsatisfactory, for buckling is likely to take place, resulting in disastrous leakage. So in most cases where actively corrosive liquid is to be conducted safely, discretion demands the so-called tube-lined pipe. This is made by expanding a lead

tube into the iron pipe and sweating or soldering the two together.

The machine that does this consists principally of a long spindle at the end of which is an "expander." This device is shown in Fig. 3. The lead tube and the iron pipe both having been tinned, the one is slid into the other and the whole placed on a support so arranged that the "expander" can enter the end of the double pipe. The pipe is heated from the outside while the "expander" is revolving, and progressing through the length of the pipe, expands the lead tube tightly against the inside of the iron pipe where the temperature and pressure cause the metals to uuite.

Lead-Lined Fittings

There is nothing radical about the procedure in making lead-lined valves and fittings. The design, however, is somewhat complicated by the necessity of providing cast-iron cores that can be removed after the lining is in place, and the need for recesses in the walls of the fitting to hold the lead in place after it is put in. It is, of course, necessary that provision be made for joints with lead-to-lead contact without detracting from the mechanical strength.

The cast-iron cores are clamped into place in the parts to be lined and the whole is immersed in a large pot of molten lead which flows through one or two openings into its rightful place. When the temperature of the liquid metal has been reached, the fitting or valve part being lined is removed, openings upward, of course, and cooled. The cores are then removed to be used again. "Hard lead" is usually used in lining valves. Hard lead contains antimony and besides resisting wear is much stronger than pure lead. A comparatively small proportion of antimony is used, but where parts are completely made of this alloy, as much as 20 per cent is sometimes employed.

Pump parts, valves, etc., are frequently made of hard lead and in their place give excellent results. Although the corrosion resistance of the lead is lowered somewhat by the addition of antimony, this is not a serious drawback unless the liquid handled is a corrosive of particular violence. It is claimed that for general acid handling a hard lead pump is unexcelled. Hard lead valves are not as rugged as lead-lined iron valves, but they have proved very expedient, financially and otherwise, in cases where they are not subjected to mechanical abuse.

The photographs shown were taken at the plant of the Lead-Lined Iron Pipe Co. at Wakefield, Mass. The diagrams do not show exactly the machines of any one manufacturer, but depict the general practice throughout the industry.

Would Burn Small Pieces of Lime

Data obtained during recent trips to lime plants in Pennsylvania, Ohio and Maine by Dr. Oliver Bowles, mineral technologist, Department of the Interior, attached to the New Brunswick, N. J., experiment station of the Bureau of Mines, are being compiled in preparation of a report on the best means of producing lime from small stone. The importance of this work is indicated by a letter recently received at the station from a lime producer who stated that at one of his plants there is an annual accumulation of 300,000 tons of small stone which cannot be utilized for lime burning under present conditions of operation.

Making Solid Tires From Latex

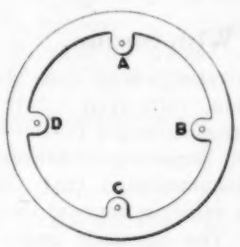
By Rudolf Ditmar

Translated from the original manuscript by Julian F. Street, B. F. Goodrich Co., Akron, Ohio.

THE latest Ditmar patent for making soft and hard rubber articles from latex was discussed in *Chemiker Zeitung* (Cothen), p. 661 (1923). In this method, substances that combine with or absorb water, such as calcium sulphate (calcined gypsum) and other inorganic and organic colloids are added to the latex; these substances remain in the finished product, acting as fillers, and do not affect the elasticity of the final product.

During overproduction and consequent cheapness of latex, this method is suitable for the manufacture of solid tires, which are fully as cheap as those hitherto made from rubber and are even more durable.

The procedure described in the patent is as follows: An iron plate is fastened to each side of a swallowtail-shaped rim. The plates are bolted to each other through the holes *A*, *B*, *C* and *D* (see illustration) so that they adhere firmly to the rim. The height of the solid tire is equal to the width of the plates minus the thickness of the rim.



The mixture of latex, calcium sulphate, sulphur and other compounding ingredients is then made up, like a batch of concrete, and spread firmly on the rim between the plates. It is then well tamped, a solid rim is attached firmly around the running surface, and the latex mixture is allowed to set. To improve the strength, fibrous materials can also be included in the formula. After setting, the tire is vulcanized in the usual way; then the ring is taken off, the plates are removed, and the tire is ready for use.

The entire process is simple, it consists in a latex-cementing (or, better, a latex-gypsum) treatment of an iron or wood rim. The solid tire thus made, however, is more durable than those hitherto manufactured, because the latex is coagulated only once, direct to the finished tire, and hence retains all its life.

Glazes Versus Abrasion Studied by Bureau of Standards

A brief description was given a short time ago in a Bureau of Standards bulletin of the apparatus which the bureau is using to determine the resistance of ceramic glazes to abrasion. Studies have recently been made of the loss in weight, during test, of the same specimen in successive intervals of time. The loss in weight is at first slow, but after the polished surface is worn away the rate of loss becomes constant for a single glaze, although it varies for different glazes. The question arises as to how long a test must be run in order to get weight losses proportional to glaze serviceability. Since it seemed desirable to answer this question without an actual service test, a method was tried in which two plates of the same brand were held in the hands and shuffled one over the other until there was a noticeable abrasion. Seven brands treated in this way 2,000 times for each pair were classified through visual observation by different observers in approximately the same order as the figures obtained with the testing apparatus.

Canadian Flaxseed Industry Thrives

Both the crop and acreage of flax in Canada last year exceeded that of the previous year. From 629,938 acres planted in flax in 1923 there was produced 7,139,500 bu. of flaxseed, an average yield per acre of 11.30 bu. In 1922, 5,008,500 bu. was taken from 2,599,520 acres, an average of 8.25 bu. per acre. Exports of flaxseed in 1923 amounted to 2,870,788 bu., valued at $6,276,228, as compared with 2,072,924 bu., valued at $4,545,268, in 1922.

Canada has eight plants using flaxseed in the manufacture of linseed oil, with a capital investment of $2,603,240. In 1922, according to a bulletin of the Dominion Bureau of Statistics, 2,431,992 gal. of raw oil and 1,001,047 gal. of boiled oil were produced, and also large quantities of oil cake, oil cake meal, refined and special oils, of a total value of $6,223,376.

Desulphurizing Coke With Steam

Experimental work on a laboratory scale on the desulphurization of coke by steam, conducted by the Department of the Interior and the Carnegie Institute of Technology at the Pittsburgh Experiment Station of the Bureau of Mines, has demonstrated that the steaming process effects a greater sulphur removal than is possible with other processes. The economic importance of the results of these experiments is that they point the way to future utilization of enormous reserves of high-sulphur coals not now suitable for coke making.

In a report giving the results of these experiments, made by Alfred R. Powell, associate chemist, Bureau of Mines, and John H. Thompson, research fellow, Carnegie Institute of Technology, it is pointed out that sulphur in metallurgical coke gives rise to many problems and difficulties in furnace operations. More than 1¼ per cent of sulphur is likely to produce an inferior grade of iron. Sulphur will, in addition to causing trouble in the furnace, make it difficult if not impossible to work the iron. Any process for removing this deleterious substance from the coke is therefore of value to both the manufacturer and the consumer of coke, if the cost is not prohibitive.

The average annual coke production of the United States during the last 10 years has been 45,404,000 tons. Approximately 60 per cent of this total has been used in metallurgical industries, chiefly iron and steel, and the remainder was consumed for domestic or gas-making purposes. The coal used in producing this quantity of coke represents annually about 15 per cent of the bituminous coal mined in the United States.

Any saving in the production of coke, even though it be relatively small, or any improvement made in the finished product, will amount to large sums. The removal of even a small part of the sulphur from the coke offers such an improvement. In addition to solving one of the principal problems of the steel industry, this removal would create a much greater coal supply from which the coke producer would draw his raw material. Many of the coals of Pennsylvania, West Virginia and Kentucky are so high in sulphur that their use for the manufacture of metallurgical coke is prohibitive, without preliminary treatment by the present known means of coal cleaning, principally coal washing, which is not always an effective remedy. Illinois has the greatest potential coal supply of any state in the Union, with the possible exception of Wyoming, which is underlain by immense fields of low-grade subbituminous coal. Nearly all of this Illinois coal will make good coke, if not alone, when used in proper mixtures with other coals; but in most cases the sulphur content is above the limit fixed by present standards. This cannot be reduced by washing in some cases, due to the peculiar combinations of the sulphur compounds in the coal. The possibility of removing part of the sulphur should interest the coal mine operator as well as the coke producer; and a new market would be created for the product of the former, which has heretofore been available only to those mining a low-sulphur coal.

Many processes have been tried for the removal of sulphur from coke, including steam; but most of them have not met with any degree of success. The investigators at the Bureau of Mines laboratories found that between 10 and 15 per cent of the total sulphur in the coke is removed by simple steaming at 750 deg. C. With alternate vacuum and pressure treatment the desulphurization is increased to 20 to 25 per cent. Furthermore it is believed that the steaming is much more beneficial than the actual sulphur reduction indicates, since the sulphur removal is almost entirely taken from the surface of the coke, and this surface sulphur may be the part that is easily absorbed by the iron in the blast furnace.

The recent rapid growth of the byproduct coking industry serves to simplify the matter of a cheap steam supply. Large quantities of heat are now allowed to go to waste, but this heat could be well utilized in the generation of steam. Thus the process of steam coke could be made comparatively inexpensive.

The investigators point out that so long as the supply of low-sulphur coals is available the steaming of coke could not be termed an industrially feasible process. However, when it becomes necessary to resort to the use of higher sulphur coals for the manufacture of coke, the improvement of the coke through steaming may be of sufficient value to warrant the expense of the process. Of the many processes thus far tried, steaming results in the greatest removal and offers the best possibilities for adaption to the coke industry.

The results of this investigation are embodied in Bulletin 7 of the Coal Mining Investigations Series, which may be obtained from the Carnegie Institute of Technology, Pittsburgh, Pa., at a price of 30 cents.

Wet-Process for Enameling Grows More Important

Wet-process enameling of cast iron is becoming important because of its application to the enameling of stove parts, sanitary fittings and hardware. Technologic Paper 246, which may be obtained from the Superintendent of Documents for 10 cents a copy, is a report of an extended investigation that the bureau has carried out of wet-process enamels for cast iron, both with and without the use of a ground coat. Compositions used in dry-process enameling have served as a basis for the work. The effect of varying methods for preparation of frits, mill additions and relation of composition of the enamel to such properties as adherence, texture and opacity have been carefully studied. The paper describes the various ground coats, cover enamels, single coat, and colored and white enamels that were tried out during the experiments. The compositions that gave the most satisfactory results are indicated.

Cost of Filtration Equipment and Operation

An Analysis and Comparison of the Factors That Determine Cost of Installation and Operation of the Three Principal Types of Filters

By W. G. Whitman and Tyler Fuwa

Assistant Professor of Chemical Engineering and Research Associate, respectively, Massachusetts Institute of Technology

THE proper selection of filtration equipment is governed ultimately by the net profit on the filtering operation—that is, by the increased value of the materials handled less the total costs of operation. Any complete economic analysis of a specific problem must consider both of these factors, since a cheap process may give an inferior product and a more expensive one may be justified by the greatly increased value of the materials.

This paper discusses the cost side of the problem and gives approximate figures on the investment and operating costs of the three main types of filters used in the chemical industry. The authors' object is to point out the method of figuring filtration costs, emphasizing the major items of expense characteristic of the various filters. Three examples are included to illustrate the general method and have been selected to represent different types of service conditions.

The first section summarizes general engineering judgment as to the suitability of different filters for certain types of work. It deals therefore with factors that influence the value of the filtration process as well as its cost. The second section presents average initial investment charges for filter apparatus of different types and sizes, and the third deals with the factors of operating cost and includes illustrative examples.

Filtration Equipment

An adequate appreciation of the characteristics of various filters is necessary to determine their relative value for any specific duty. The following section summarizes certain of the essential engineering features of filter presses, leaf filters and rotary vacuum filters—the reader is referred to other sources for a more comprehensive survey.

Filter presses are the most widely used type of filtration apparatus in the chemical industry. Cast-iron presses are designed for pressures up to 150 lb. per sq.in. and represent about the majority of the presses now in use. Wood presses find considerable use in handling acid liquors and are built to stand pressures of 50 lb. per sq.in. Cypress, yellow pine or maple woods are generally employed.

Filter press construction differs in detail, but the two main types are the recessed plate and the flush plate-and-frame. In the former, the cake space is obtained by recessing the filter plate, so that a space of ½ to 1 in. is left between plates when the press is closed. In the latter, a spacing frame (½ to 4 in.) is inserted between filtering plates to provide cake space. The volume of cake space is therefore more flexible in the plate-and-frame press.

The product from filter presses is delivered as a cake that is more or less firm depending on the material, the pressure and the time employed. The formation of a unit cake that is fairly dry and can be handled gives the filter press a decided advantage over other types of pressure filters. On the other hand, this type of cake can be obtained only by continuing filtration until the press is filled with solid, and there are therefore definite upper and lower limits to the cake capacity per square foot of filtering area for a definite thickness between filter plates. To meet this point the proper width of spacing or distance frames for the particular slurry being handled can be determined for average conditions.

Filter presses are widely used for slurries where the solid constituent is to be saved. Washing can be employed with fair satisfaction depending considerably on the material being filtered. Unquestionably their chief advantage lies in low initial cost, and this is frequently an overwhelming advantage in small installations or in new ventures in production. They are made in a wide variety of capacities, and the filtering units are readily replaceable. On the other hand, the capacity per square foot of filtering area is lower than with pressure leaf filters, and the labor cost of cleaning and reassembling is a very serious objection in large installations.

Pressure Leaf Filters—Pressure leaf filters represent the development of the filter press with a view to reducing labor costs and increasing capacity per unit filtering area. Essentially all the types consist of a closed steel drum or casing containing rigid filtering leaves. The slurry is pumped into the drum under pressure, while the filtrate escapes through the leaves and is piped away. In the Kelly and Sweetland filters these leaves are rigid, and in the Vallez type they are mounted on a rotating shaft.

The pressure leaf filters are primarily adapted for clarification purposes, particularly with hot liquids. They have high capacity and low labor requirements for filtering slurries containing only small amounts of solids. They represent a more expensive initial investment than the filter press and hence are not generally employed in small installations. Washing can be carried out with good efficiencies in these filters, but they are unsuited for work where a fairly dry cake must be discharged.

Continuous Vacuum Filters—Continuous rotary vacuum filters represent a development of filtration along the lines of high capacity and continuous operation. They

FILTRATION

It is of course significant that filtration is one of the most generally used methods of separating solids from liquids—a problem that is encountered in almost every chemical engineering industry. And therefore it is obvious that any information of a fundamental nature on this unit process will have wide application and interest. The authors have supplied in this article a unique set of data collected with the generous co-operation of the manufacturers of filtration equipment and have interpreted it so that it will be of direct practical value to the production men in industry. It is a constructive attempt to answer the question, "What does filtration cost?"

A UNIT PROCESS OF CHEMICAL ENGINEERING

consist of rotating filtering drums or disks which dip into the slurry to be filtered. As the cake passes through the bath it is pulled onto the filter by suction from inside the filter and the moisture in this cake is pulled through the filter after emergence from the bath. Washing may be applied, if desired, near the top of the path of rotation, and a further drying would then follow. The cake is discharged on the downward travel by means of a scraper blade, with or without the aid of compressed air from inside. The exact arrangement of this cycle is dependent on the type of filter and of material under treatment.

The continuous vacuum filter is admirably adapted for handling granular free filtering solids and operates on these with high capacity and low labor cost. The uniform discharge of a fairly dry cake is a considerable advantage, especially where the filtration is one unit in a series of continuous operations. This filter cannot generally be used with slimy precipitates, is not very successful in handling liquids near the boiling point, the initial investment is high and power costs form an important item of expense.

Initial Cost of Equipment

The initial cost of equipment has an important bearing on overhead factors of operating cost and is therefore one of the major considerations in the selection of equipment. Since the total initial investment represents the expense required up to the point of productive usefulness, the cost of accessories and of installation is logically included in the following discussion.

For purposes of comparison the costs for different types of equipment should be expressed on a common basis. An ideal basis for filtration costs should consider both the capacity and the efficiency of the machine. However, since capacities vary so widely with the material being filtered, with the machine and with the operating conditions, and since the significance of the term "efficiency" is determined by the specific requirements made on the filter, such an ideal basis cannot be obtained. The most satisfactory practical cost basis is the square feet of filtering area, which is a good capacity factor when applied to any one machine on a definite slurry. It should be remembered, however, that the capacity per square foot varies widely both with the material and with the type of machine, and further that this basis is not in any way related to washing efficiency, dryness of cake and the like, all of which may determine value of operation. Realizing these limitations, the above basis is nevertheless of considerable value in the presentation of costs and in the preparation of cost estimates. The accompanying figures have been expressed as cost per square foot of filtering area and are plotted against the total square feet of filtering area in the machine.

Filter Presses—Fig. 1 shows the cost of flush wood, flush iron and recessed iron filter presses, varying from the 12-in. laboratory press to the 48-in. press. The costs are

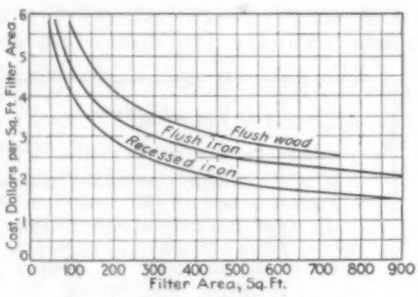


Fig. 1—Cost of Filter Presses
This is figured with plates but without any accessories

figured for full presses, and in the flush wood and iron presses the frames are 1½ in. thick. To obtain the cost of any filter, the cost per square foot should be multiplied by the total square feet of filtering surface. For example, a flush iron press with 300 sq.ft. of filtering surface costs 300 × $3 = $900.

The cost of accessories and of installation would be a matter of considerable variation in each specific case. Figures for accessories (pumps and strainers) of 20 to 25 per cent and for installation (not including tanks) of 25 to 30 per cent represent fair approximations of the average costs. In the above example the complete cost of the press installed would then be $900 + (0.50 × $900) = $1,350, taking a figure of 50 per cent for accessories and installation combined.

The cost of presses using different widths of distance frames do not vary markedly from the values in Fig. 1. The same is true where the press is only partly filled with plates. The reason for this is that the filter plates themselves form the major item of cost in the total. Table I shows the costs of the various units of the press.

Pressure Leaf Filters—The cost of filter machines of the pressure leaf type is indicated by Fig. 2. It will be seen that the cost curves are of the same type as for filter presses—that is, the cost per unit filter area decreases rapidly with size. While the cost of filters of the press type is roughly proportional to the number of plates, and the cost of the empty press is relatively small, such is not true of pressure leaf filters. In this latter case the cost of the body or shell is a relatively large item, and the cost of frames is not a controlling factor. Furthermore, the cost per unit filter area of pressure leaf machines is dependent to a large extent upon the spacing of the frames within the body. Thus the cost per unit filter area for 4-in. spacing of frames is from 30 to 50 per cent greater than for a 2-in. spacing. Advantage should be taken of the smallest allowable spacing, which, of course, will be governed by the cake thickness desired.

A suitable centrifugal liquor pump and equipment for compressed air are the usual accessories, and the cost of these should not exceed 20 per cent of the cost of the filter machine. Installation costs will vary somewhat with the amount of necessary piping, but will approximate 25 per cent of the total cost of equipment.

Continuous Vacuum Filters—Fig. 3 shows the cost of continuous vacuum filters, both with and without accessory equipment. Owing to

Table I—Costs of Filter Presses

Size (inches)	12	18	24	30	36	42
Weight empty press (lb.)	650	1,550	3,000	4,000	5,500	7,800
Weight press filled with 2 in. iron frames (lb.)	1,100	8,100	14,400	21,200	30,100	40,600
Cost of empty press	$130	$170	$230	$300	$370	$460
Area per plate, sq.ft.; iron	1.6	3.5	6.6	10.7	16.0	22.4
Area per plate, sq.ft.; wood	1.0	2.5	4.8	7.7	10.7	15.1
Plate capacity of one press	15	50	50	50	50	50
Cost of plates per sq.ft.						
Filter area:						
Rec. iron	$3.20	$2.10	$1.50	$1.25	$1.15	$1.07
Plate and frame Iron	$4.90	$3.30	$2.40	$1.90	$1.70	$1.70
Plate and frame Wood	.....	$5.20	$3.33	$2.34	$2.10	$1.92

Example:
To figure cost of flush iron press to give 700 sq. ft. filtering area in one 36-in. press:
Cost = $370 + (700 × 1.70) = $1,560.00.

the fact that considerable accessory equipment is required for the operation of this type of filter, the total of these items will range from 50 per cent in the small sizes to 30 per cent in the larger sizes of the base machine cost.

The cost of installation is about the same as in the case of the pressure leaf type or about 25 per cent of the total cost of equipment. It will be noted that the unit cost of this type of filter is many times that of the filter press, and considerably more than the pressure leaf types.

In Fig. 4 the base costs of the three types of filter machines are compared for the sake of convenience. More detailed information on each type may be had from the other curves, referred to in the foregoing discussion.

Cost of Filter Operation

The important charges to operation may be classed as follows:

(1) Investment charge.
(2) Depreciation charge.
(3) Cost of power.
(4) Cost of direct labor.
(5) Cost of maintenance and supplies.

The practice of charging equipment with 6 or 7 per cent annually is a general custom, based, of course, on the idea that if the money were invested outside the business, it would then earn at least that rate.

However, to compensate for the business risk involved, money invested in industrial equipment should earn much more than the conventional interest rate of 6 per cent. Ordinarily, these net earnings on invested capital are at least 20 per cent. While in the actual accounting of operating expenses, 6 per cent only should be charged to the investment, the expected earnings of 20 per cent or more should be kept in mind in the purchase of equipment.

In every case, then, where the more expensive filter machine is chosen, the additional investment over the cost of a cheaper type must be justified by a definite increase in the net profit of operation, either through increased value of the product or through unmistakable economies of operation. To choose otherwise is poor engineering.

All the charges to operation, with the exception of the investment charge, will vary with the type of equipment being used. In the discussion that follows these operating charges will be treated in turn under each type of filter and illustrated by means of examples taken from actual plant practice. The total cost figures obtained in the three illustrations must not be used as a direct comparison of the three filters themselves, since the duties and service conditions vary widely in these examples.

Filter Presses—With regard to depreciation, no rigid factors can be stated, for the reason that filter practice varies within wide limits, even in handling any one type of slurry. Generally speaking, however, a filter press of rugged construction will depreciate but 10 per cent a year under conditions where a neutral slurry is involved. With care in operation, this figure may be lowered to 5 per cent. On the other hand,

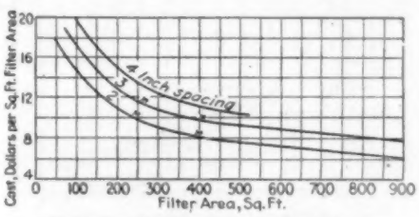


Fig. 2—Cost of Pressure Leaf Filters

corrosive slurries may cause 100 per cent depreciation; in such instances, however, a wooden press should be employed. Even under severe conditions a press made of this material will stand up 2 or 3 years when acid slurries are being filtered. With proper handling, wooden presses will remain serviceable as long as those made of iron.

Power requirements, in the case of a typical free filtering metallic salt, will be about 0.005 hp. for each square foot of effective press area. With compressible sludges this figure may increase enormously, on account of the high working pressures involved.

Labor requirements are fairly uniform for a given type of installation. Filter presses require the most constant attendance, and this is the one greatest offset to their low first cost. Two men are ordinarily needed full time for the operation of two presses of medium size (24-in. presses having 200 sq.ft. of filter area each), assuming a two-hour operating cycle.

Aside from the replacement of cloth, very little maintenance is required of filtration equipment as a whole. A figure of 3 to 5 per cent a year on the total initial cost of the filter is an average maintenance charge, exclusive of the replacement of the filtering medium.

With filter presses, where the cloth is continually being disturbed and scraped, a life of from 3 to 4 weeks may be expected, this assuming 10-hour daily operation and working with a sludge of precipitated metallic salt. Suitable cotton duck or chain cloth for press work may be had for 11 cents per square foot.

Illustrative Example of Filter Press Operation:

In this example, the equipment and operating specifications are as follows:

(*a*) Two 24-in. square filter presses are used, each having thirty chambers, 1-in. frames, a filtering area of 211 sq.ft. and a total effective volume of 8.79 cu.ft.

(*b*) The slurry is a precipitated metallic salt, the cake of which before drying contains about 40 per cent moisture and the dry weight of which is 80 lb. per cu.ft. The cake is washed down to 0.01 per cent soluble matter.

(*c*) About 8,000 gal. of slurry is to be filtered per 8-hour day, 300 days a year, the length of cycle being 2 hours, which includes filtering, washing, blowing with air and cleaning the presses. Eight batches, 8.79 cu.ft. per batch, dry weight 80 lb. per cu.ft., are produced per day = 2.81 tons of solids.

1. Investment Charge—From Fig. 1 it will be seen that a flush iron press having 211 sq.ft. filter area will cost $3.45 per sq.ft. Then the cost of the two presses will be

$3.45 \times 211 \times 2 =$ \$1,460.00

The cost of accessory equipment and installation will be 50 per cent of the base cost,

$1,460 \times 0.50 =$ 730.00

The total investment is \$2,190.00

The daily charge to investment, at 6 per cent per year, assuming 300 working days, will be

$$\frac{2,190 \times 0.06}{300} = \$0.43$$

2. Depreciation Charge—Assuming 10 per cent uniform depreciation per year on the total investment, the daily charge will be

$$\frac{2,190 \times 0.10}{300} = \$0.73$$

3. Cost of Power—Assuming the cost of power to be 1c. per hp.-hour, and the power consumption to be 0.005 hp. per sq.ft., the total power cost for 8 hours will be

$211 \times 2 \times 0.005 \times 0.01 \times 8 =$ \$0.17

4. Cost of Direct Labor—With labor at \$4.00 per day, the charges for two men will be

$4.00 \times 2 =$ \$8.00

5. Cost of Maintenance and Supplies—With prepared cotton duck at 11c. per sq.ft., and an expected life of 22 working days of 8 hours, and assuming the cloth area per press to be 260 sq.ft., the cloth cost per day will be

$$\frac{0.11 \times 260 \times 2}{22} = \$2.60$$

Assuming repairs and all other necessary maintenance at 3 per cent per year, we have

$$\frac{2{,}190 \times 0.03}{300} = \$0.22$$

making a total maintenance charge of $2.82

Summary of Daily Costs:

		%
1. Investment	$0.43	3.5
2. Depreciation	0.73	6.0
3. Power	0.17	1.4
4. Labor	8.00	65.8
5. Maintenance and supplies	2.82	23.3
Total cost	$12.15	100.0

$$\text{Cost per ton of solids} = \frac{12.15}{2.81} = \$4.32$$

From the foregoing illustration, it will be seen that labor and filter cloth constitute the greater part of filter press operating costs, being in this case almost 90 per cent of the total.

Pressure Leaf Filters—The useful life of pressure leaf filter machines is about the same as that of filter presses. This is to be expected, since the materials of construction and the slurries involved are practically the same with both types. An overall depreciation of 10 per cent yearly would certainly be conservative practice in the majority of installations. Here, again, the corrosiveness of the slurry is the controlling factor. With care, the bodies of leaf filters should last 20 years, while the frames will have to be replaced every 5 years or so.

Power is required for the operation of the liquor pumps and will range from 0.005 to 0.02 hp. per square foot filter area, depending upon the head and the capacity of the equipment.

Pressure leaf filters require much less constant attention than do filter presses; in fact two men can operate four or five pressure leaf machines, each having 1,000 sq.ft. filter area. A battery of nine or ten such machines will require a foreman and a mechanic in addition to the two operating men, for the most efficient results.

Cloth replacement is a relatively unimportant factor in operation, as compared with filter presses, for two reasons: First, the filter capacity is usually two or three times greater with pressure leaf filters than in the press type, and second, the life of the cloth is increased considerably on account of the absence of scraping or other disturbances very often a factor in press operation. As a rule, cotton cloth will stand from 6 weeks to 6 months service in pressure leaf operation, assuming 10-hour day production. Current prices for cotton cloth range from 9 to 10c. per square foot. Other items of maintenance and repair will not exceed 5 per cent per year, and may be as low as 3 per cent.

Illustrative Example of Pressure Leaf Filter Operation:

In this example, calculations are based on the following machine specifications and operating data:

(*a*) A battery of nine pressure leaf filters is used, each machine having a net filter area of 1,040 sq.ft.

(*b*) The slurry is a sugar liquor of sp.gr. = 1.27. Kieselguhr is used as a filter-aid.

(*c*) Operation is on the basis of 24 hours per day, 300 days per year. Production is 500 tons of dry solids per day. The total volume of liquor handled is 167,000 gal. per day, some of which is filtered twice.

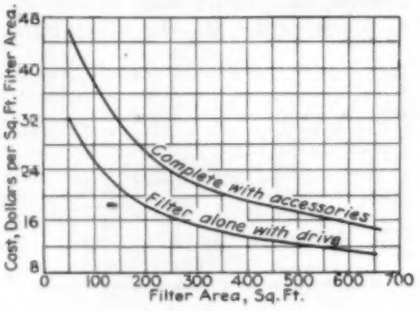


Fig. 3—Cost of Vacuum Continuous Filters

1. Investment Charge—Referring to Fig. 2, the cost of a pressure leaf filter with 3-in. spacing and 1,040 sq.ft. area is $7.80 per sq.ft. Then the cost of nine such presses will be

$$7.80 \times 1{,}040 \times 9 = \$73{,}000.00$$

The cost of accessory equipment and installation will be 40 per cent of the base machine cost,

$$73{,}000 \times 0.40 = 29{,}200.00$$

The total investment is $102,200.00

The daily charge to investment, at 6 per cent per year, will be

$$\frac{102{,}200 \times 0.06}{300} = \$20.44$$

2. Depreciation Charge—Assuming 10 per cent uniform depreciation per year on the total investment, the daily charge will be

$$\frac{102{,}200 \times 0.10}{300} = \$34.07$$

3. Cost of Power—Assuming the cost of power to be 1c. per hp.-hr., and the power consumption to be 0.01 hp. per sq.ft. (including pumping and steam for heating liquor) the total power cost for 24 hours will be

$$1{,}040 \times 9 \times 0.01 \times 24 = \$22.50$$

4. Cost of Labor—Two operators are required per 8-hour shift, at $4. For 24 hours this is

$$2 \times 4.00 \times 3 = \$24.00$$

One mechanic is required per 8-hour shift, at $5,

$$1 \times 5.00 \times 3 = \$15.00$$

One foreman, per 8-hour shift, at $5,

$$1 \times 5.00 \times 3 = \$15.00$$

Total labor per day $54.00

5. Cost of Maintenance and Supplies — Assuming filter cloth at 11c. per sq.ft., and an expected life of 60 days of 24 hours each, the daily replacement cost of cloth is

$$\frac{1{,}040 \times 9 \times 0.11}{60} = \$17.15$$

Assuming all other maintenance at 3 per cent per year, we have

$$\frac{102{,}200 \times 0.03}{300} = \$10.22$$

Total maintenance and supplies per day = $27.37

Summary of Daily Costs Not Including Kieselguhr:

		%
1. Investment	$20.44	13.3
2. Depreciation	34.07	22.3
3. Power	22.50	14.7
4. Labor	54.00	32.0
5. Maintenance	27.37	17.7
Total daily cost =	$158.38	100.0

$$\text{Cost per ton of solids} = \frac{158.38}{500} = \$0.31$$

About 3 tons of kieselguhr is used per run of 167,000 gal. liquor. At $50 per ton, this is a daily charge of

$$3 \times 50.00 = \$150.00$$

Adding this to the above costs, the total becomes $308.38 or $0.61 per ton.

In contrast with filter press operation, the foregoing summary shows that labor costs are considerably less with pressure leaf machines and that a filter-aid, when necessary for operation, becomes a very prominent item of filter cost.

Continuous Vacuum Filters—In the case of complete installations of continuous vacuum filters, the auxiliary equipment amounts to from 30 to 50 per cent of the total cost, which is a considerable factor in the determination of an overall depreciation rate. Conservative practice would seem to indicate a uniform rate of 10 per cent, the same as for other types of filter machines. There is no doubt that under favorable conditions a lower figure would be allowable.

The power requirements of continuous vacuum machines are relatively high, on account of the load taken by the vacuum pumps. Power will vary enormously with the type of slurry handled, and with the prop-

erties of the cake. In the case of mining concentrates, 0.05 hp. per square foot of filter area is a good average figure. Hot solutions having a high vapor pressure should not be handled in this type of machine, owing to the limited capacity of the vacuum pumps and excess power necessary for vapor removal.

Of all the types of filter machines, a continuous vacuum installation will show the greatest labor economy. One attendant is sufficient for every four to six machines, and two operators, together with one repair man, can handle a battery of twenty continuous vacuum filters. Such low labor costs are due to the absence of cyclic opening, dumping and cleaning, and to the fact that the filter medium has a very long life.

Maintenance, exclusive of cloth renewals, will average 5 per cent of the total installation value. On continuous vacuum filters, duck cloth will stand up from 1 to 2 years in neutral slurries. Where the slurry is acidic, woolen cloth is used, and has a life of from 1 week to 5 months, depending upon the acid concentration. Close woven Monel metal cloth, as used in the filtration of caustic soda slurries, may be depended upon for several years of satisfactory service. Monel cloth costs about $2 per square foot, woolen cloth for vacuum filtration costs 20c. per square foot and cotton duck for ordinary work is 7 to 8c. per square foot. On account of the low working pressure involved, a cheap grade of duck will give good service on vacuum filter machines.

Illustrative Example of Continuous Vacuum Filter Operation:

In this example, the equipment and operating specifications are as follows:

(*a*) One continuous vacuum filter is used having a net filter area of 600 sq.ft.

(*b*) The slurry is calcium carbonate in caustic liquor, a fairly free filtering material, whose rate is about 700 lb. dry solids per sq.ft. filter area.

(*c*) Operation is on the basis of 24 hours per day, 300 days a year. Production is 200 tons of solids per day.

1. Investment Charge — Reference to Fig. 3 will show that a continuous vacuum filter, without accessories, costs $11.20 per sq.ft., assuming 600 sq.ft. capacity. The machine cost is

$$11.20 \times 600 = \$6{,}725.00$$

Taking the cost of accessory equipment as being 40 per cent of the base cost, this will add

$$6{,}725 \times 0.40 = 2{,}690.00$$

The installation cost will be about 25 per cent of the total equipment or

$$6{,}725.00 \times 0.25 = 1{,}681.00$$

Total investment is $11,096.00.

The daily charge to investment, at 6 per cent per year, will be

$$\frac{11{,}096.00 \times 0.06}{300} = \$2.22$$

2. Depreciation Charge—Assuming 10 per cent uniform depreciation per year on the total investment, the daily charge will be

$$\frac{11{,}096.00 \times 0.10}{300} = \$3.70$$

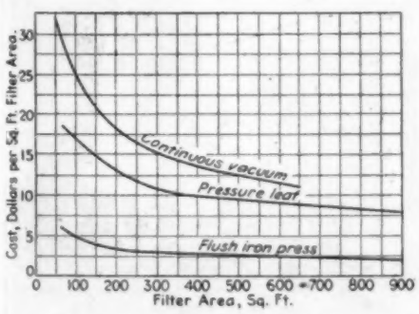


Fig. 4—Comparative Cost of Filter Machines

3. Cost of Power—Assuming the cost of power to be 1c. per hp.-hr., and the power consumption to be 0.05 hp. per sq.ft. filter area, the total power consumption for 24 hours will be

$$600 \times 0.05 \times 0.01 \times 24 = \$7.20$$

4. Cost of Labor — In a small installation, such as this, assume ½ of 1 man's time on each 8-hour shift. At $4.00 per day, this will be

$$\frac{4.00 \times 3}{2} = \$6.00$$

5. Cost of Maintenance and Supplies—Assuming the use of Monel cloth at $2 per sq.ft. and having a life of 2 years, cloth replacement per day will be

$$\frac{600 \times 2.00}{2 \times 300} = \$2.00$$

Assuming all other maintenance and repairs at 5 per cent on the total investment, this will be

$$\frac{11{,}096.00 \times 0.05}{300} = \$1.85$$

Total maintenance and supplies per day ..... = $3.85

Summary of Daily Costs:		%
(1) Investment	$2.22	9.7
(2) Depreciation	3.70	16.1
(3) Power	7.20	31.3
(4) Labor	6.00	26.1
(5) Maintenance	3.85	16.8
Total daily cost =	$22.97	100.0

Cost per ton of solids = $\frac{22.97}{200}$ = $0.11

From the above cost summary, it will be seen that power and fixed charges are relatively important items in continuous vacuum filter operation. This means that such a filter is best adapted to 24-hour operation.

In conclusion, the authors wish to express their appreciation for the data and assistance given by Arthur Wright, D. R. Sperry & Co., T. Shriver & Co., the Oliver Continuous Filter Co. and the United Filters Corporation.

Resistance of High-Alumina Cements to Action of Salt Water

Owing to the interest that has been aroused by "fused" or "high-alumina" cements, it has been found necessary to print additional copies of Bureau of Standards Technologic Paper 197, "Cementing Qualities of the Calcium Aluminates." This paper gives the data obtained from test pieces made of eight different cements of this type, burned in the experimental plant at the bureau. In addition to the usual small mortar test pieces required by the specifications for portland cement, 6x12-in. cylinders of a 1:6 and 1:12 gravel concrete were made and tested at various periods up to and including 3 years.

In general the results confirmed the statements issued abroad in regard to the early hardening of these cements, as evidenced by the strength of 3,145 lb. per sq.in. for a 1:6 concrete at the end of 24 hours, and 880 lb. at the same period for a 1:12 concrete. In view of the fact that the 3-year data presented in the paper were obtained during 1920 and the data for the earlier periods at a time previous to that, the bureau is now engaged in making more of these cements to investigate such important points as the resistance to sea water and sulphate waters.

To Exploit Thenardite Deposits

The immense deposits of thenardite in Arizona, in the Rio Verde region, are to be exploited. Western Chemicals, Inc., has erected a plant at Campe Verde, where the raw material will be coarse-crushed, washed, fine-crushed, washed again, screened and dried.

The plant, which is designed for an output of 400 tons per day, is expected to produce at a total expense of $12.50 per ton, including transportation in motor truck to the railroad at Clarkdale.

Equipment News

From Maker and User

Centrifugal Pumps

Design Now Placed on Market Claims to Eliminate Several Troublesome Faults

The centrifugal pump has become so familiar to all and is so universally used with satisfaction that one is not in the habit of expecting great improvements to be made in the design of this equipment. Yet the Moore Steam Turbine Corporation, Wellsville, N. Y., in announcing that its new line of centrifugal pumps is ready for the market, claims two distinct advances, in addition to all the excellent features heretofore found in successful pumps.

These two features are the use of an improved rubber sealing ring on the impeller between the suction and discharge chambers, and the use of a metal graphite packing ring in the packing glands instead of the ordinary flax packing.

The average user of a centrifugal pump is usually in search of high efficiency. The shop test on a pump is run under ideal conditions—with the packing gland nuts loosened—so that the flax packing in the stuffing box will not create a "drag" on the shaft. After the pump is placed in operation, any workman in the plant may pack the stuffing box as tight as possible and squeeze the packing together until there is no leakage. This exerts a powerful pressure between the flax packing and the shaft and consequently lowers the efficiency of the pump. Sufficient tightening of the packing will often "stall" the prime mover.

The metal graphite packing rings rest lightly upon the revolving shaft. There is no binding effect to retard rotation. This packing ring is in no way affected by hot or cold water and once it is properly fitted, leakage is reduced to a minimum. Its life is practically unlimited when the shaft runs without eccentricity. It means that the shop test efficiency of the pump will always be maintained in service. The efficiency cannot vary or be dependent upon the whims of a plant workman.

The pumps of this new design are horizontally split, perfectly balanced, use brass-protected chrome nickel steel shafts, and are built to limit gages in a shop equipped for and accustomed to precision work. They are built single and multi-stage, for motor, turbine or belt drive.

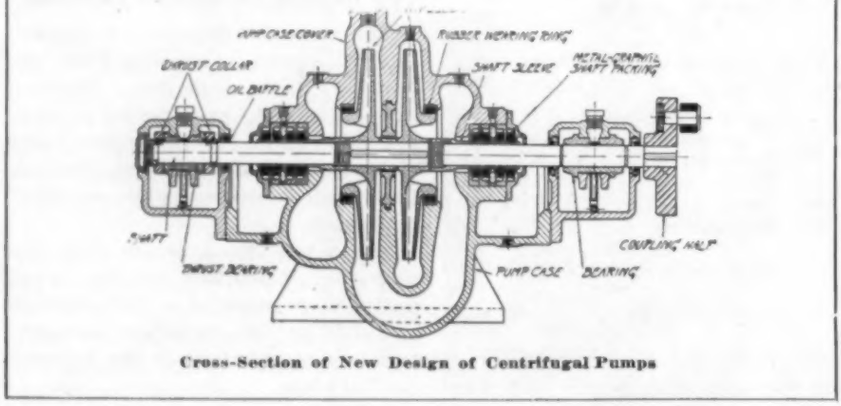
Portable Device for Painting Factory Walls

Portable Painting Device

Almost every plant is under the necessity of doing some painting from time to time in the ordinary course of plant maintenance. Those that do not happen to have expert painters readily available will undoubtedly be interested in the new portable paint-spraying device illustrated herewith.

This portable equipment is one of the products of the Spray Engineering Co., 60 High St., Boston, Mass., and is called the "Extralite." It consists of an electric motor or gasoline engine driven compressor; a 3-gal. paint container; a control consisting of reducing valve, gage, paint and air strainers, and water separator mounted on the container cover; and a paint gun with spreader attachment. Included with this are sufficient quantities of air and paint hose and electric cord.

The total weight of the outfit as shown in the illustration is about 130 lb. If the gasoline engine is supplied, it weighs about 135 lb. This, the makers claim, is lighter than any similar device procurable. It is said to cover flat surfaces from three to four times as fast as can be done with brush work. On irregular or inaccessible surfaces, such as radiators and coils, even greater speeds are obtained. It is claimed that work done by this device is free from marks, laps, runs or sags, is uniform, and looks and wears better than brush work.



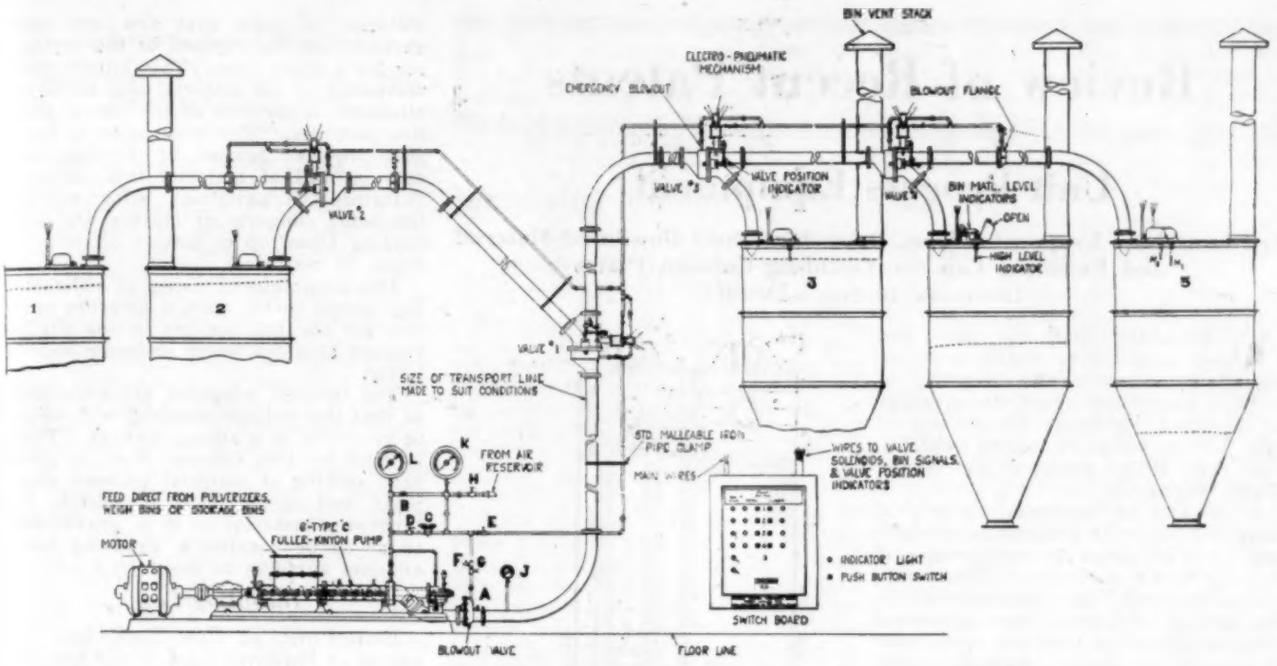
Cross-Section of New Design of Centrifugal Pumps

Conveying Pulverized Materials

A system has been developed by the Fuller Engineering Co. and the Fuller-Lehigh Co., of Fullerton, Pa., for the conveying of pulverized materials such as pulverized coal, which should prove of much interest to those having such substances to handle. It is claimed by the designers of this system, which is called the Fuller-Kinyon system, that it is free from accident, fire and explosion hazards and that it is more flexible and simpler in operation than other systems.

This system embodies four essential elements (see cut): (1) A power-driven pump the function of which is to control the feed and push the material through the conveyor line. (2) A source of compressed air supply for aërating the material. (3) A conduit through which the material is conveyed. (4) Distributing valves which divert the flow from the main line to the various branch lines and thence to the furnace bins. A refinement which facilitates its operation is an electro-pneumatic indicating and remote-valve controlling device. By this means the operator is advised when the material in each bin has reached a predetermined level by the automatic lighting or extinguishing of an electric bulb mounted on a central switchboard. On the same board is a series of push-buttons through which switching valves are actuated. Thus the operator can effectually control the flow of material to any bin without leaving his station in the milling room or elsewhere.

The conduit is usually built of black steel pipe, properly jointed to provide a continuous smooth bore. The



System for Conveying Pulverized Material

diameter depends on the capacity desired and ordinarily varies from 2½ to 8 in. An air-line, bypassing the pump, parallels the conduit and furnishes the air supply for actuating the electro-pneumatic distributing valves. Pressure from this line is also used for clearing the transport line after the pump is stopped.

The distributing valves are disk multiple-discharge port type, electro-pneumatically operated and controlled from a switchboard conveniently located. Bin material-level indicators are mounted on each bin. When the level of the material rises in the bin to a predetermined point, it operates a signal light and at the same time shuts off the flow to that particular bin and directs it to the next in line.

Referring to the cut, the sequence of operations is as follows: All the distributing valves are opened to the branch lines by the push-button controls on the switchboard. The air is turned on through the reducing valve and permitted to flow through the conduit. The pump motor is then started and material is fed to the system. The initial flow is into bin No. 2; when the level of the material reaches the paddle of the bin indicator, the electro-pneumatic valve mechanism of valve No. 2 is set in motion, the valve is closed to the branch line and the main line is opened to discharge to bin No. 1. When bin No. 1 is filled, valve No. 1 is automatically thrown and the supply goes to bins No. 3, No. 4 and No. 5, successively. The last bin in the series, which corresponds to No. 5 in the illustration, is equipped with two bin indicators *H*1 and *H*2; the suspended paddle *H*1 being placed on a lower level than *H*2. Instead of having electrical connections with any of the valves *H*1 is in circuit with a "klaxon horn" and *H*2 with the pump motor control. When the level of material reaches the lower paddle a "klaxon" is sounded warning the operator that the bins are full. If the warning is not heard or goes unheeded until the upper paddle is deflected, the pump motor is automatically stopped, thus preventing overflowing of the bin.

Electric Melting Pots

An electric melting pot for melting and maintaining at working temperature soft metals and alloys such as solder, babbitt, lead and zinc is one of the recent developments of the Westinghouse Electric & Manufacturing Co. This melting pot, which is made in two sizes, of 150-lb. and 750-lb. capacity, has a thermostatic control that automatically keeps the temperature of the molten metal at any desired point between 450 and 950 deg. F. A small electric motor controlled by a thermostat throws the snap switch on or off as the temperature of the metal reaches the high or low limit set by the operator, and an even working temperature is thus secured.

The heating element and all its connections are mounted on the melting crucible, which can be lifted out of its outside casing to make the element accessible. The outside casing surrounding the crucible is lined with a layer of heat-insulating material to reduce radiation losses and insure cool shop conditions. The control panel, which may be mounted in any convenient position, consists of magnetic contactors and relays for opening and closing the line circuit. An instrument panel, which is set up adjacent to the pot, contains a thermostat with temperature-regulating pointer, a push button switch for turning the current on or off, and a rod signal lamp that serves as a warning in case the heat is left on accidentally.

One of the advantages claimed for this electric melting pot is that it permits the use of lead-base babbitt rather than the tin-base alloy. Lead-base babbitt is much less expensive than the tin-base and forms an equally good alloy, but it is greatly affected by either overheating or pouring too cold and therefore can be used only where it can be poured at a constant, accurate temperature. With the temperature control possible through the use of electricity for heating, the pouring temperature can be so regulated that the use of lead-base babbitt is made possible. Thus a substantial reduction in the cost of babbitting is effected.

Sealing Hydrogen Holders

Much difficulty has been experienced in securing a suitable liquid seal for gas-holders containing pure hydrogen. This has been a problem of particular moment to the Bureau of Standards, and its experience and findings are detailed in Bulletin 75. According to this report, various liquids have been tried and so far crude glycerine has proved the most successful. Analyses made of hydrogen which had been stored in a gas holder over crude glycerine showed that the rate of absorption of nitrogen by diffusion through the glycerine was about half the rate when machine oil was employed. This experiment seems to be along the right lines and the bureau announces that it believes most of the nitrogen was contained in the glycerine and that later analyses will show a diminished rate of nitrogen absorption. These experiments will no doubt be suggestive to makers of such equipment.

Manufacturers' Latest Publications

STREAMLINE FILTER CORPORATION, 95 Liberty St., New York City.—A new booklet on the Streamline Filter.

THE FULTON CO., Knoxville, Tenn.—An amusing booklet entitled: "Sam Sylphon, a Flexible Fellow. A two act play, by Fultonius Companibus."

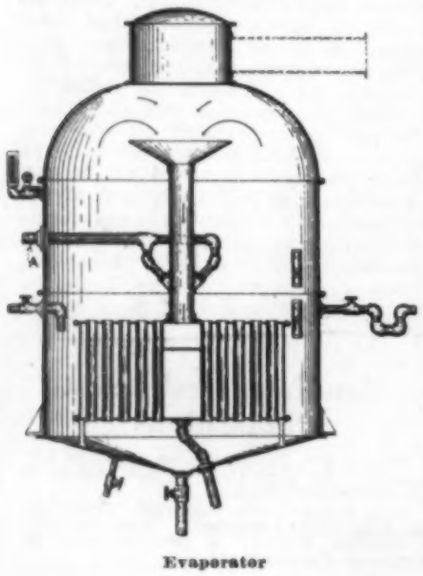
Review of Recent Patents

Unit Process Equipment

Self-Contained Evaporator Unit, Drier for Finely Powdered Material and Bubbling Cap for Distilling Column Plates Discussed in Some Detail

AN EVAPORATOR for cane and beet sugar juices which is so designed as to avoid the necessity of vacuum pumps and sweet water pumps is described by Oscar M. Nelson, of New Haven, Conn., in Patent 1,481,924, Jan. 29, 1924, assigned to United States Sugar Co.

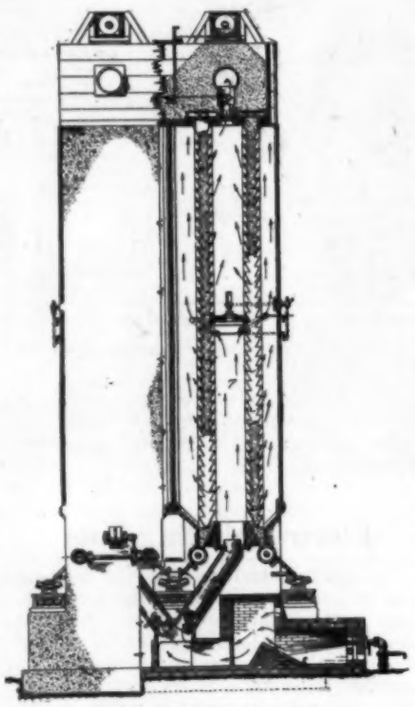
It consists of the usual cylindrical body provided with a closed dome which may have an outlet for excess vapor if this is found necessary. The steam drum, supported by legs fastened to the bottom of casing, has a vertical tube extending up from the center and ending in a flaring funnel mouth. Steam from *A* entering this vapor return pipe through jets creates sufficient suction to draw the vapors from the boiling solution down into the steam drum. The tubes in the drum are so arranged that the steam circulates around all of them. A baffle plate just under the vapor return pipe aids in deflecting the steam around the tubes. Condensate is removed through a pipe connected to the bottom of the drum. By this arrangement uniform circulation and consequently uniform heating of juice is accomplished without the aid of pumps or other mechanical circulating devices. This makes a self-contained unit.



Evaporator

Drier for Finely Divided Material

As received from the quarry, diatomaceous earth contains considerable moisture which is difficult to remove because of the extreme porosity of the material. William E. Roberts, of Lompac, Calif., has developed a special type of furnace for drying this material. (1,482,812, Feb. 5, 1924.) As will be evident from the accompanying illustration, the furnace is divided into units each of which has two vertical chutes down which the earth passes from an overhead bin to the discharge mechanism at the bottom. These chutes are built up of staggered inclined plates so designed that the material does not overflow but remains suspended in the form of a vertical curtain through which it is possible to pass gases with comparatively little resistance. Into the chamber between the two curtains, hot gases enter through an opening in the bottom. The gases pass transversely through the material forming the curtains, being entirely deflected to the outside chambers by a horizontal baffle about halfway up the furnace. In the upper portion of the furnace they are drawn back through the curtains to the central chamber, escaping through exhaust flues at the top. Before this second pass the temperature of the partly saturated gases is raised by bypassing some of the hot incoming gases around the curtains.



Drier for Fine Material

The hot air current is drawn through the material without interruption, but the flow of material is periodic and controlled as to motion and amount. It is desirable to have the curtain wall of material come regularly after it has been allowed to flow downward a short distance, in order that new and wet surfaces can be exposed to the drying air for a short time. This interrupted movement of the material also helps to eliminate separation of the coarse and fine particles. This separation is further provided against by dividing the curtain wall of material into narrow curtains, the partitions being within the baffle supports or louvers and extending from top to bottom of curtain walls of materials.

The advantage of using an exhausting system rather than a pressure system for the hot air lies in the slight vacuum obtained which promotes capillarity.

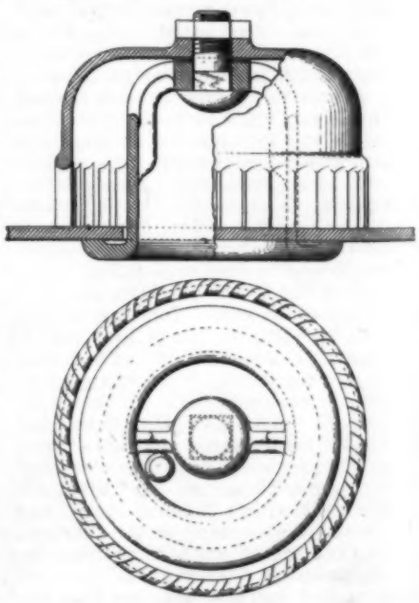
The inclined supports are arranged so that the inclosed material will move or gravitate in a zigzag manner. This is done for two reasons: first, to prevent arching of material between supports and second, more completely to turn over material as it is gravitated so as to be constantly exposing new and wet surfaces to the drying air.

Bubbling Cap

Emil Piron, of New York, has designed an improved hood or cap for use in absorption devices such as distilling columns or rectifying columns. This is described in Patent 1,482,408, Feb. 5, 1924, assigned to Piron Coal Distillation Systems.

In the usual type of bubbling cap plate the liquid flows slowly in a horizontal direction across the plate. With the vapors or gases leaving the caps radially or in a direction at right angles to the walls of the caps, there is a tendency for the slowly moving liquid to become saturated at points adjacent to the vapor openings. This results in a decrease in absorption efficiency.

One form of Mr. Piron's design is shown in the accompanying figure. It will be noted that the hood rests on the plate and that the lower portion of the hood is slotted. The slots are nonradial, so that the vapors in passing through tend to set up swirls or eddies in the liquid, thus producing thorough mixing and better absorption.



Bubbling Cap

Lithopone Process

Non-Oxidizing Atmosphere in Muffle Prevents Formation of Zinc Oxide

Maintaining a non-oxidizing atmosphere in the lithopone muffle and adding small quantities of sulphur to the press cake as means of overcoming zinc losses are suggested by Edward C. Holton, of Olmsted Falls, Ohio, and Jay C. Owens, of Chicago, Ill., in Patent 1,480,807, Jan. 15, 1924, assigned to Sherwin-Williams Co.

With this process, the muffling step may be considered as consisting of two phases: first, a phase in which the material is heated in an atmosphere in which the oxidizing action is negligible and the shrinking or densifying action is considerable; and second, a phase in which a slight oxidation takes place just before quenching.

In the first phase of the muffling step the oxygen in the interstices of the press cake is consumed by the deoxidant, and since a non-oxidizing atmosphere is maintained in the muffle, there will be no oxidation of the zinc sulphide of the lithopone. During the second phase, which occurs after the muffle has been opened, the heated material is exposed to the atmosphere for a brief interval and during this interval, except for the presence of the deoxidant, there would be considerable oxidation of the zinc sulphide, but because of the presence of the deoxidant, the latter consumes the oxygen of the atmosphere which comes in contact with the material, and as a result there is practically no oxidation of the zinc sulphide. The amount of deoxidant added to the lithopone should be carefully regulated in accordance with the conditions of operation of each particular furnace so that after the quenching step practically all of the deoxidant will have been oxidized and removed either by passing off as a gas prior to quenching, or by being dissolved in the quenching water.

Increasing Bonding Power

Surface Treatment to Produce Pitting Improves Bonding Qualities of Abrasive Grains

Miner L. Hartmann, of Niagara Falls, N. Y., in Patents 1,482,792 and 1,482,793 (Feb. 5, 1924, assigned to the Carborundum Co.) discusses a method for improving the bonding properties of "crystalline mineral materials," a term which he uses to include natural and artificial abrasives and refractories of a crystalline nature.

When abrasive grains are held to other bodies or together by a bonding material, such as glue, rubber, shellac, vitrified clay, cement or other bonding materials, the efficiency of the abrasive article depends largely upon the adhesive strength between the grain surfaces and the bonding material.

Mr. Hartmann has found that by suitable chemical treatment the smooth surfaces of the grains may be etched, pitted or roughened so that the adhesive strength between the grain and the bonding material is greatly increased.

As an example, fused crystalline aluminous abrasive grains are moistened with a saturated solution of sodium fluoride. The moistened grain is then heated to about 500 deg. C. for about an hour. A saturated solution of sodium fluoride is approximately 4 per cent, therefore a small percentage by weight of the salt is left on the material. The amount of the salt left on the material is not more than 1 or 2 per cent of the weight of the material itself. After cooling, the grain may be washed with water and then dried and is then ready to be used in the abrasive article.

Acidic substances, such as boric acid, phosphoric acid, nitric acid and silicic acid, may also be used to produce this effect.

Purifying Hydrocarbons

After Sulphuric Acid Treatment, the Hydrocarbons Are Crystallized in Presence of Alkali Solution

David F. Gould, of Cornwells, Pa., has described a method of refining hydrocarbons in Patent 1,481,197, Jan. 15, 1924, assigned to The Barrett Co.

The process may be illustrated by a specific example, using naphthalene as a typical hydrocarbon: 60,000 lb. of molten impure naphthalene is washed by agitation with 1,450 lb. of 66 deg. Bé. sulphuric acid, the acid being subsequently settled and drawn off. This washing may be repeated as many times as is advisable. Following the drawing off of the last acid the molten naphthalene is washed with 750 gal. of hot water, which is settled and drawn off. A second similar water wash is given. The naphthalene, still somewhat acid, is pumped molten into the crystallizing agitator, which contains 400 gal. of 27 per cent caustic soda solution. the mixture is agitated and about 6,000 gal. of cold water is run in slowly so as to cool the mixture and cause the naphthalene to crystallize. The aqueous liquid is drained away from the naphthalene crystals and the crystals washed with water to remove the caustic soda and other impurities. The naphthalene is then ready for final distillation.

American Patents Issued February 19, 1924

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests, and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,483,797—Dyeing and Printing Acetyl Silk and Materials Containing It. Arthur G. Green and Kenneth H. Saunders, Manchester, England, assignors to British Dyestuffs Corporation, Ltd., Manchester, England.

1,483,798—Dye and Process of Making the Same. Arthur George Green and Kenneth Herbert Saunders, Manchester, England, assignors to British Dyestuffs Corporation, Ltd., Manchester, England.

1,483,830—Oil Filter. Norman Y. Moore, Delanco, N. J.

1,483,835—Preparing Chemical Products From Olefines and Olefine-Containing Mixtures. Alexander S. Ramage, Detroit, Mich., assignor to Bostaph Engineering Corporation, Detroit.

1,483,852—Process of Making Zinc Chloride. Ludwig Rosenstein, San Francisco, Calif., assignor to Great Western Electro Chemical Co.

1,483,856—Method of Manufacturing Rubberized Fiber Composition. Paul Beebe, Akron, Ohio, assignor to Goodyear Tire & Rubber Co., Akron.

1,483,917—Oxyhydrogen Steam Generator. Ernest E. Tucker, New York City.

1,483,929—Centrifugal Machine. William C. Coleman, Wichita, Kan.

1,483,932—Rock and Ore Crushing Mill. Oscar Andrew Ellis, San Francisco, Calif., assignor to Axel E. Ellis, Boston, Mass.

1,483,933—Dry-Crushing Mill. Oscar Andrew Ellis, San Francisco, Calif.

1,483,961 — Paper-Making Machine. Ezekiel J. Wilson, East Greenbush, and Edwin A. Rees, Albany, N. Y., assignors to F. C. Huyck & Sons, Rensselaer, N. Y.

1,484,002—Apparatus for Separating Liquids From Solids. Joseph Avrutik, Yonkers, N. Y.

1,484,004—Process for the Production of Products Containing Cellulose and Alkyl Cellulose. Ernest Berl, Darmstadt, Germany.

1,484,014—Process for Conversion of Hydrocarbon Oils and Similar Substances. Victor Lee Emerson, Philadelphia, Pa.

1,484,018—Obtaining Products From Chlorinated Hydrocarbons. Henry A. Gardner, Washington, D. C.

1,484,078 — Gas-Cleaning Apparatus. George P. Pilling, Philadelphia, Pa., assignor to Freyn, Brassert & Co., Chicago.

1,484,088—Lead Compound and Process of Forming the Same. John W. Schumacher, Detroit, Mich., assignor to Acme White Lead & Color Works, Detroit, Mich.

1,484,118—Continuous Tunnel Kiln. Conrad Dressler, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., New York City.

1,484,129—Hygrometer. Albert Hermann, Madison, Wis., and Carl A. Menzel, Chicago, Ill., dedicated, by mesne assignments, to the People of the United States of America.

1,484,167—Cleaning Solvent. Victor S. Allien, Wilmington, Del., assignor to Darco Corporation, Wilmington, Del.

1,484,190—Solidification of Organic Liquids. Arthur B. Ray, Flushing, N. Y.

1,484,225—Method of Producing Gas. Carl Lundin, Pittsburgh, Pa.

1,484,249—Manufacture of Alkyl Compounds. Walter Bader, Spondon, near Derby, England, assignor to Dr. Henry Dreyfus, London, England.

1,484,254—Production of Cement and the Like. Otto Dormann, Stettin, Germany.

1,484,256—Intermittent System for Treatment of Coal. James T. Fenton, Salt Lake City, Utah.

1,484,257—Continuous System for the Treatment of Coal. James T. Fenton, Salt Lake City, Utah.

1,484,260—Apparatus for Sublimation. Harry D. Gibbs, San Francisco, Calif., by mesne assignments dedicated to the People of the United States for their free use and enjoyment.

1,484,298—Pulverizer Mill. Harry Raymond Collins, Allentown, Pa., assignor to Fuller-Lehigh Co.

1,484,370—Composition Substitute for Wood, Tile or Other Building Material. Francis A. Bartlett, Stamford, Conn.

1,484,445—Method of Treating Hydrocarbons. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Co., Chicago.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials or other topics of interest

Damage Resulting From Explosions

To the Editor of Chem. & Met.:

SIR—In your Legal Notes column, issue of Feb. 4, appears an interesting account of an action for damages against the Atlas Powder Co., which is a good illustration of how injustice may be done by too great reliance on expert pedantry in legal battles.

It appears that an expert on explosives testified that the structural damage from the explosion of 1,000 lb. of dynamite is limited to 530 ft. Anyone who has handled explosives to any extent outside the laboratory knows that they are the most freakish things under the sun and that no arbitrary rule can be placed on where they will and will not do structural damage.

To illustrate: The explosion of 20 tons of TNT in Seattle Harbor in 1915 did structural damage 35 miles away, though many structures within a mile were absolutely undamaged. By this expert's rule it would have required some thousands of tons to do structural damage at 35 miles. I presume that if he had testified in damage suits resulting from that explosion, the court would have ruled that there were several thousand tons of explosive on the barge (whose capacity, by the way, was about 100 tons). I have seen structural damage done at greater than 530 ft. by a little as 50 lb. of dynamite. On the other hand, I have stood within 100 ft. of a 30-lb. charge when it misfired without even being thrown off my feet. An acquaintance of mine in prewar times stood within 50 ft. of a tank containing 1,000 lb. of "nitro" when it exploded. He was unhurt, though structural damage was done 2 miles and more away.

The plain fact is that explosive damage is done by shock, which is transmitted in wave form. Waves in the earth travel at higher speed and have a different period than those in the air. Waves starting out in different directions in the air may be deflected by topographic conditions so as to come together. When they come together, they may do so in such a way as to reinforce each other or to neutralize each other. A reinforced air explosion wave may be still further reinforced at certain points by an earth explosion wave. The earth waves may also be deflected by irregularities of topography or by differences in the material underlying the soil. They may also reinforce each other at points and neutralize each other at other points. A maximum earth wave in one phase at a given point and instant combined with a maximum air wave in the opposite phase at the same point and instant will produce the maximum structural damage. That there is no definite range limit within which such a combination can occur under the proper circumstances is not expert testimony, but it is common sense.

The explosive effect of a charge in a gun is vastly increased in one direction by being limited in others. The same may occur outside a gun by the presence of a confining range of hills, or mass of buildings.

Downers Grove, Ill. LEO G. HALL.

Weighted Index Number for Motor Fuels

To the Editor of Chem. & Met.:

SIR—The letter by Dr. R. E. Wilson in the Jan. 27 issue of your journal, in which he discusses methods of estimating motor fuel volatility, raises several objections to the weighted index number for motor fuels proposed by the writer. Concerning Dr. Wilson's contention that the index number is no improvement over the 85 per cent point, the writer does not feel that it is necesary to say much. The index number agrees more closely with the dew-point than does the 85 per cent point, and the agreement is better the more accurately the dew-points are known; this fact is illustrated by the case of Co-operative Gasoline A, where the dew-point, as directly determined by the writer, lies exactly on the curve, while Dr. Wilson's indirect dew-point, plus an averaged constant, shown by the writer's work to be necessary (*Ind. Eng. Chem.*, 1923, vol. 15, p. 796), lies 6 degrees off the curve. The averaged constant expresses the difference between Wilson and Barnard's indirect dew-points and those directly determined by the writer, and should serve to smooth out irregularities in experimental work.

Concerning Dr. Wilson's statement that there is no relation between the lower portion and the upper portion of the distillation curve of a gasoline, the writer feels that a correction should be made. That such a connection does exist is shown by the influence of added casinghead gasoline on the dry-point of a blending naphtha. It is found in practice that a naphtha will have its dry-point lowered 10 deg. F. by blending with 20 per cent of fairly light casinghead (dry-point 300 deg. or less). Colonel G. A. Burrell has called the writer's attention to a case in which 35 per cent of casinghead of dry-point 244 deg. lowers the dry-point of a naphtha from 437 to 415 deg. F. It is not possible to compare other points on the distillation curve, because they refer to per cent condensed, rather than to per cent distilled; because of the failure to condense all light hydrocarbons, the points on the distillation curve of the blend are shifted up to an unknown extent. If it were possible to compare directly the "per cent distilled" curves of naphtha and blend, there is no doubt that the lowering indicated at the dry-point of the blend would show all along the curve. Such an effect on the distillation curve would not fail to change the dew-point. Dr. Wilson's own work has shown that "Red Crown" and "Fractionated B" gasolines have dew-points 32 deg. F. apart, although the distillation curves are practically identical beyond the 65 per cent point. This difference in dew-points of these fuels must be attributed to a difference in the composition of the portion boiling below the 65 per cent point. In other words, there is no doubt that the dew-point depends on the composition of the whole fuel and not on the composition of the higher boiling portion only. It is then rational to include points on the lower range of the curve, as the writer has done.

The weighted index number gives a single figure for the comparison of motor fuels, a figure derived by simple addition, which does not require special mathematical gifts and is not complicated. The calculation of an index number from distillation data actually takes not more than 30 seconds, and is considerably simpler than the calculations in other routine operations of a testing laboratory, say a B.t.u. determination on fuel oil.

The writer believes that the index number will serve much better to tell the whole story about a gasoline and to show up freak blended fuels than will any single point.

Pittsburgh, Pa. W. A. GRUSE.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. A brief résumé of each article is included in the reference given. Since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

LA CONDENSATION DU GAZ. *A. Grebel* and *H. Bouron.* A discussion of the physics of gas condensation in gas plants and byproduct coke works. *Le Genie Civil*, Feb. 9, 1924, pp. 130-133.

LA CARBONISATION DE LA HOUILLE. *Etienne Audibert.* An article that discusses various researches under way on this subject and summarizes the conclusions that are indicated. *La Technique Moderne*, Feb. 1, 1924, pp. 77-82.

WEIRTON'S NEW BYPRODUCT COKE PLANT. *C. H. Hunt.* A description of the latest installation of Becker ovens to be put into service. *Iron Age*, Feb. 21, 1924, pp. 573-577.

TREND IN THE SCIENCE OF METALS. *Zay Jeffries.* The first half of an abstract of the annual lecture of the Institute of Metals Division of the A.I.M.E. *Iron Age*, Feb. 21, 1924, pp. 571-572.

WHAT IS STEEL? *Albert Sauveur.* The first Henry Marion Howe memorial lecture presented at the annual meeting of the A.I.M.E. It includes an explanation of red shortness of low-carbon steels at certain temperatures. *Iron Age*, Feb. 21, 1924, pp. 581-583.

CHARACTERISTICS OF HEATING CURVES. *E. J. Janitzky.* Their applicability for calculating the time required to reach constant head temperatures as in heat-treating. *Transactions* of American Society for Heat-Treating. February, 1924, pp. 201-208.

News of the Industry

Summary of the Week

Development of catalyst to double efficiency of nitrogen fixation is announced by Professor Lamb of Harvard University.

Paper week plans nearing completion with broad range of exhibits assured at Paper Industries Exposition.

Action on Muscle Shoals question expected in House this week.

American Institute of Chemists interests itself in development of employment contract.

Exports of chemical products in January were 10 per cent larger than those for December.

Naval stores industry is working on plans for formation of national organization.

Successful use of airplanes for calcium arsenate dusting may lead to similar method of distributing paris green for mosquito extermination.

The government has filed an appeal in its case against the Chemical Foundation for the return of the German dye patents.

Committee of the Engineering Foundation favors federal appropriation to Forest Products Laboratory for Survey of the paint and varnish industry.

Litigation over the Old Hickory powder plant settled by payment to the government of $1,700,000.

Important Advance Made In Nitrogen Fixation

New Catalyst Developed at Government Laboratory Nearly Doubles Efficiency of Process

Nitrogen fixation by a new method that will give much more economical production is announced by Prof. Arthur B. Lamb of the Harvard University department of chemistry. The new process, which was perfected at the Fixed Nitrogen Research Laboratory of the Department of Agriculture, is regarded as of first importance in relation to the production of nitrates for fertilizers, for the manufacture of explosives and other commercial products.

The new development has been made possible by a catalyst superior to any that have been available in the past. Since the principal problem in the successful operation of such plants as that at Sheffield, Ala. (nitrate plant No. 1) hinges on the use of such a catalyst, the development of a very reactive and stable one by the laboratory is probably the greatest single achievement of the institution since its inception.

In commenting on the development Professor Lamb says in part: "It was one of the chief tasks of the Fixed Nitrogen Research Laboratory to prepare a catalyst just as good or superior to that of the Germans. The new catalyst which the laboratory has developed, largely through the efforts of Alfred T. Larson, Ph.D., has more than met these requirements. Where the German catalyst would yield 7 or 8 per cent of ammonia, this new catalyst will yield 14 per cent and has been run continuously for 6 months without deterioration. It means cheaper ammonia, cheaper nitrogenous fertilizers and therefore cheaper food."

The Fixed Nitrogen Research Laboratory was established by the government when it became apparent how indispensable nitrogen compounds were for military and agricultural purposes.

Professor Lamb, who for several years has been director of the Harvard laboratory, and who, when the Washington laboratory was established, was Lieutenant-Colonel in charge of defense chemical research, was appointed first director of the government institution. With several army officers he went to Germany after the war to inspect plants established there to manufacture nitrates from the air. Under his direction the present investigations were undertaken. The present director of the laboratory is Dr. F. G. Cottrell.

Chemical Foundation Suit Is Appealed by Government

The United States Government has appealed from the decision of the United States District Court which was rendered adversely recently by Judge Hugh M. Morris in its suit for the return of numerous German dye patents by the Chemical Foundation, Inc. The appeal is signed by James M. Beck, Solicitor-General of the United States; Attorney-General Daugherty and other federal counsel.

Seventeen allegations of error are made in the appeal, which is general rather than specific, and concludes: "The court erred in each and every one of its conclusions of law and fact contained in its opinion in this case made a part of the record."

Federal Aid Sought for Survey of Paint Industry

A special committee of the Engineering Foundation has reported in favor of a non-commercial investigation into the nature and use of paint and varnish. For this purpose the committee recommends that Congress should place at the disposal of the Forest Products Laboratory about $45,000, which is estimated to be equal to one-hundreth of 1 per cent of the value of paint used annually in this country.

Wins Canadian Fellowship

The Canadian Fellowship of Chemical Science valued at £600 has recently been awarded to Edward H. Boomer, a graduate of McGill University, Montreal. Dr. Boomer is only 24 years of age. He was awarded a Dominion Government scholarship for 1921-22 and also for 1922-23. In 1923 he obtained the degree of Ph.D. and was awarded the Ramsay Memorial scholarship, under the terms of which he has been working at Cambridge University. He will now spend a year of research in London, England.

Western Electric Pledges Support for Critical Tables Compilation

A pledge of $5,000 toward the preparation and publication of the International Critical Tables of Physical and Chemical Constants has been made by the Western Electric Co. This is taken by supporters of this work to indicate the merit of the plans for the Critical Tables. It is felt that the support of this company could not have obtained if it were not believed that the Tables are needed by large as well as by small research laboratories.

Special Fellowships Offered at University of Washington

The College of Mines of the University of Washington has announced the offer of five fellowships for research in mining, metallurgy and ceramics in co-operative work with the Bureau of Mines. The fellowships are open to graduates of universities and technical schools who are properly qualified to undertake research investigations. The value of each fellowship is $810 per year of 12 months, beginning July 1. Fellowship holders pay the usual tuition and part laboratory fees; they register as graduate students and become candidates for the degree of Master of Science in Mining Engineering or in Metallurgy or in Ceramics, unless an equivalent degree is already held.

The purpose of these fellowships is to undertake the solution of various problems being studied by the United States Bureau of Mines that are of special importance to the State of Washington, the Pacific Northwest and Alaska. The investigations consist principally of laboratory work directed largely by the bureau's technologists. For the year 1924-25 the following subjects have been selected for investigation: Beneficiation of coal, especially coal washing; electrometallurgy (iron and steel problems, super-refractories), and ceramics (super-refractories, whiteware bodies and other problems).

American Chemical Society Supports Mellon Plan

The executive committee of the American Chemical Society, which has a membership of nearly 15,000, has voted to support the Mellon tax reduction plan, it is announced by the treasurer of the society, Dr. John E. Teeple of New York.

The society acted in response to a communication from Owen Johnson, secretary of the Authors League of America, urging that the chemists join other groups in forming the Federation of American Professional Societies to seek relief in behalf of the country's professional workers.

"By direction of President Leo H. Baekeland," the announcement said, "this communication was presented to the executive committee. The executive committee by a large majority voted 'in favor of the American Chemical Society joining or co-operating with the Federation of American Professional Societies in public support of the Mellon tax program as a non-partisan measure of immediate economic necessity and justice.'"

Canadian Fuel Found Valuable

Experiments at the Hamilton, Ont., byproducts coke-oven plant have shown that the bituminous coals of Nova Scotia and New Brunswick are suitable for domestic coking purposes, according to a statement issued by the Dominion Fuel Board. "The structure of the coke produced at Hamilton in these tests is said to be very dense and heavy," the statement continues, "thereby becoming a very excellent domestic fuel."

News in Brief

Canadian Pulpwood Commission to Speed Up Its Work—The commission inquiring into the pulpwood situation in Canada, in order to expedite its work, has divided into two parts. There has been some criticism of the length to which the hearings have been drawn out and the fact that a report from the commission would not likely, at the present rate of progress, be received by the federal authorities until next fall. With the commission divided into two parties much time will be gained. One section of the commission will hold hearings in the western provinces and the other section will complete the work in the east.

American Bauxite Co. Wins Case on Production Tax—An injunction to prevent the State of Arkansas from collecting 25 cents a ton severance tax on bauxite ore taken from the ground by the American Bauxite Co. has been granted by Chancellor J. P. Henderson. It was shown that the producing company had an investment of about $2,500,000 and that its earnings have varied from 3 to 7½ per cent. This favorable decision will result in the continuation of normal mining activities. The company is not contesting the regular 2½ per cent tax on the product, which amounts to more than 5 cents a ton, and has been paying that tax regularly. Ninety per cent of the bauxite ore from which aluminum is made is mined from the property of this company, near Benton.

Ontario Feldspar Deposits Being Rapidly Developed—Intensive development is taking place at the feldspar quarry of the Perth Feldspar & Mining Co. in the township of Bathurst, Lanark, Ont. On this property of 100 acres there is a dike of feldspar 1,000 ft. long and 300 ft. wide, rising from 40 to 60 ft. over the main highway intersecting the area. Operations are at present confined to this hill, which apparently contains several hundred thousand tons of marketable feldspar. An analysis of the ore shows 65.10 silica, 21.50 alumina, 12.61 potassium oxide, and small proportions of sodium oxide, magnesium lime and ferrous oxide. The product is all being shipped to a grinding plant at Rochester, N. Y.

Directory of Industries of West Virginia Published—In a directory of the industries of West Virginia which has just been issued by the State Bureau of Labor the manufacturers of carbon, chemicals, glass and glass products, gasoline, oil, ice, iron and steel products, medicines, paper, pulp, salt, and paint are listed. Gas and compressing stations as well as tanneries are also included. As well as being arranged by industries, the directory is arranged by counties and cities and gives the name and address of the company, nature of business, male employees, female employees and total employees.

Organic Industry Expanding in Canada—Equipment for the production of ethyl and amyl acetates, not hitherto manufactured in Canada on an extensive scale, is being installed in the new plant of the Canadian Industrial Alcohol Co. at Corbyville, Ont. Other features of the expansion will be the installation of a still with a capacity of 10,000 gal. a day, and equipment for the recovery of carbonic acid gas.

West Virginia Pottery Plant Opened—Production has been commenced by the Homer Laughlin China Co., East Liverpool, Ohio, in the clay shops at its new pottery across the Ohio River at Newell, W. Va., said to be the largest and most modern plant of this character in the world. It has been constructed at a cost in excess of $1,000,000. Other departments will be placed in service at an early date, until a maximum of about 400 workers are engaged. The new pottery is equipped with three tunnel kilns, the first such to be installed in this locality. Joseph M. Wells has been appointed superintendent at the plant.

California Safety Meeting Coming Soon—Industrial safety and health and public safety will be discussed by prominent leaders in the safety movement at the Pacific Safety Conference to be held at the St. Francis Hotel in San Francisco, April 7 to 9. The meetings are to be held under the joint auspices of the Society of Safety Engineers of California and the Engineering Section of the National Safety Council. The first three sessions will be devoted to industrial safety and health and the fourth to public safety.

Metric Standards Bill Rouses Comment—The nationwide interest in the Britten-Ladd metric standards bill, now before Congress, is evidenced by discussion of the metric issue in current business and industrial publications. A notable series of articles on "The Meaning of the Metric Move for Business and Nation," by A. Guyot Cameron, is now appearing in *Forbes Magazine*.

Navy Opens Bids for Supplies—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will take bids until March 11 for four electric annealing furnaces for use at the Fore River Station, Mass., and Camden, N. J., navy yard, as per schedule 1914; also, at the same time, for the same yards, for two electric melting furnaces, schedule 1921; until March 4, for 45 crucibles for the Philadelphia, Pa., yard, schedule 1916; until March 11, for 2,500 lb. powdered aluminum for the Philadelphia yard, schedule 1926; until March 11 for 500 gal. marine glue for the same yard, schedule 1928; until March 11 for 2,325 lb. aluminum alloy for this same yard, schedule 1932; and until March 18 for 7,000 lb. ammonium chloride, for the Puget Sound, Wash., yard, schedule 1927.

Akron Chemists Hear Wyckoff—The Akron section of the American Chemical Society held its meeting at the Goodyear Tire & Rubber plant on Feb. 20. The speaker for the evening was Dr. R. G. Wyckoff of the Geophysical Laboratory, Washington, D. C., whose subject was "X-Rays and Crystal Structure."

Washington News

Airplane Dusting May Increase Use of Paris Green

The success attained in the use of airplanes in dusting calcium arsenate over fields of growing cotton led the Bureau of Entomology to carry out similar experiments in which paris green was used over swamp areas as a means of mosquito control. The results of these experiments have just been analyzed by the Bureau of Entomology and show encouraging results.

These experiments are of great significance in that a general resort to airplane dusting over swamps would call for large supplies of paris green and would have a potential value of many millions of dollars to such states as New Jersey, Louisiana and Mississippi, where there are large expanses of tidal marshes which can not be reached by other methods of mosquito control.

The experiments will be continued. Poisons other than paris green also are to be tried.

Muscle Shoals Question to Be Up in House

The Muscle Shoals question is likely to be acted on in the House this week due to the decision of Republican leaders to take up the McKenzie bill authorizing acceptance of Henry Ford's bid after passage of the revenue bill.

As reported by the House Military Affairs Committee, the McKenzie bill carries an amendment, proposed by Representative Madden, Republican, Illinois, providing for the replacement at Muscle Shoals of a steam power plant similar to the one sold recently to the Alabama Power Co.

Opponents of the bill, led by Representative Hull, Republican, Iowa, have indicated that they will make no attempt to prevent its consideration, but will make a vigorous fight against it on the floor.

Alcohol Production in Poland Expected to Decline

Elbert Baldwin, assistant trade commissioner at Warsaw, reports that during 1922-23 there were 1,209 distilleries active in Poland, producing 80,000,000 liters of 100 per cent alcohol, largely potato alcohol, as against 2,404 active distilleries and a production exceeding 220,000,000 liters prior to the war. Due to unsatisfactory economic conditions and to a somewhat smaller potato crop, production in 1923-24 is expected to reach only 60,000,000 liters.

Domestic consumption amounts to about 60,000,000 liters, or 2 liters annually per capita. In 1922-23 exports of alcohol reached 500,000 liters, which went largely to Germany. Shipments during the coming year will be limited to stocks carried over from preceding years and for which no estimate is obtainable, since current production will probably not exceed domestic requirements.

Old Hickory Suit Settled for $1,700,000

Nashville Industrial Corporation Reaches Agreement With Government Outside of Court

Attorney-General Daugherty recently added $1,700,000 to the fund already secured in behalf of the government on account of "war fraud" investigations when a decree was entered in the United States District Court at Nashville, Tenn., terminating the litigation between the United States and the Nashville Industrial Corporation involving the Old Hickory powder plant. This settlement in favor of the government brings the total amount recovered by Mr. Daugherty in cash settlements and compromise adjudications to more than $6,000,000.

Criminal Suits Stand

Besides the civil case against the Nashville Industrial Corporation, indictments charging criminal conspiracy in the Old Hickory case are pending in the Supreme Court of the District of Columbia against Everly M. Davis, A. W. Phillips and E. C. Morse, the latter being the director of sales in the War Department at the time he and certain other persons participated in making the successful bid upon the property. Immediately after the acceptance of the bid by Morse et al., their rights were assigned to the Nashville Industrial Corporation, a concern composed of business men of Nashville and Denver. The government's investigation into the circumstances attending the sale of the property disclosed no evidence of fraud on the part of those now interested in the property, and no indictments were returned against any of them. Allegations of fraud, however, resulted in indictments against Morse and his colleagues who negotiated the original sale. The government still maintains its criminal actions pending against these men and the Attorney-General has declared that he will waive none of its rights in respect to the prosecution of these indictments.

The Old Hickory powder plant, which was constructed by the Dupont Engineering Co. in 1917-18 and cost the government $85,000,000 to build, is located 8 miles from Nashville, Tenn., and is the largest powder factory in the world. About 90,000,000 lb. of smokeless powder is stored there at the present time and the rights of the government in regard to the storage of this powder and other property on the premises are retained by the government by the terms of the decree.

History of the Litigation

Because of the questionable circumstances surrounding the original bid, as well as the making of the contract of sale, and the disputes between the government and the purchaser as to the amount actually due on the sale and the meaning of the terms of the contract, the Attorney-General instituted suit in July, 1923, to set aside the sale. Following the institution of the government's suit negotiations were opened by the Nashville corporation looking to a settlement without trial, and after prolonged conferences the Attorney-General and the entire executive personnel of the war transactions section of the Department of Justice agreed upon terms which are embodied in the decree just entered in favor of the government to the amount of $1,700,000, $1,000,000 to be paid in cash and the balance in three deferred payments extending over a period of 2 years, and the government to maintain its criminal actions. In addition, all claims of the corporation for credits due are disallowed. To secure the unpaid purchase money the deed for the property is retained in escrow until the entire balance is paid, in addition to which the corporation is compelled to make deposits of cash or government bonds at the rate of at least $10,000 a month until $250,000 has been paid.

War Department Approves

The outcome of the case has received the approval of the War Department. Under the terms of the decree the receivers of the court in charge of the property are to be discharged and the custody of the property turned over to the corporation. All costs of the litigation are decreed against the defendants.

Naval Stores Industry Plans National Organization

A national organization is to be set up by the producers and consumers of naval stores in the United States. Formal action to that end was taken at a recent meeting of the principal men engaged in the industry at Savannah. A detailed plan for the organization is being worked out and will be laid before a conference to be called when the plan of organization has been perfected. It was the general feeling among those assembled that such an organization would make possible more systematic co-operation among all branches of the trade and could be used effectively to stabilize and to give permanency to the American industry.

It was pointed out at the Savannah conference that naval stores have been produced in the same areas in France for generations. Replanting operations are conducted systematically and the trees are so conserved that the permanency of the operations in many restricted localities is assured. In the United States the abundance of turpentine-bearing trees has led to wasteful practices. The industry has been forced to move from place to place in order to maintain its production. The time has come, however, when it is necessary to follow the example of the French and conserve the new growth.

While it was admitted at the conference that the day probably never again will come when domestic producers can furnish necessary turpentine required by the ever-increasing paint and varnish output of the country, it was declared that the present rate of output can be maintained. To do this, however, strict attention must be given to reforestation and conservation.

Chemical Exports Gain in January

Imports Also Were Larger Than in Preceding Month

Exports of chemicals and allied products in January were valued at $9,676,070, an increase of nearly 10 per cent over the value of exports in December and even a greater increase over the value of exports in January, 1923. There was a substantial gain in exports of coal-tar products. In January the figure reached $1,283,024. This compares with $1,064,435 in December and is more than double the value of coal-tar products exported in January, 1923.

The January figures show exports of 28,219,190 lb. of sodas and soda compounds. This is a slight increase over December exports, but falls somewhat below the mark reached in January, 1923. Fertilizer exports took a decided turn upward. The exports of these materials in January amounted to 85,200 tons, or nearly half as much as was exported during the entire year 1923. Likewise there was a large expansion in the volume of exports of sulphate of ammonia. The January total was 13,497 tons, as compared with 8,520 in December and 8,605 tons in Januray of 1923.

Explosive shipments out of the country turned upward sharply during January. The value of these exports during that month was $368,815. This is more than double the figure for January, 1923, and 60 per cent greater than those of December. Exports of pigments, paints and varnishes declined slightly, but were valued at $1,144,792. The figure, however, is substantially larger than that of January, 1923. Some of the other figures taken from the January returns, with the comparative figures for January, 1923, are as follows:

	January 1923	January 1924
Aniline oils and salts, lb.	34,435	18,659
Sulphuric acid, lb.	956,328	569,897
Calcium carbide, lb.	733,110	1,265,262
Copper sulphate, lb.	377,922	487,046
British gum, lb.	1,021,744	1,943,027
Formaldehyde, lb.	158,923	469,566
Cyanide of soda, lb.	81,408	1,906,086
Sal soda, lb.	730,420	1,018,305
Phosphate rock, tons	26,589	7,647
Phosphate pebble, tons	27,567	57,671

Imports of chemicals and allied products were much greater in January than in December or in January, 1923. The increase, however, was confined to chemicals on the free list. The January total was $12,748,528 for free list chemicals alone. This compares with $8,465,516 for December and $9,164,648 for January of 1923. Imports of dutiable chemicals declined. The January figure was $2,864,672. The value of December dutiable imports was $3,027,355 and those of January, 1923, were $3,570,070.

The increases were well spread over the entire classification. The value of coal-tar chemicals imported in January was $2,659,634, a very large increase as compared with December, when the figure was $1,280,811, and with January, 1923, when the total was $1,168,438. Fertilizers to the extent of 265,112 tons were imported in January, a decided increase over December. The paint group alone showed a falling off. January imports were valued at $215,720. Certain of the detailed comparisons are as follows:

	January 1923	January 1924
White arsenic, lb.	1,879,639	1,925,486
Sulphuric acid, lb.	1,350,780	1,104,260
Chloride of ammonia, lb.	1,269,293	172,815
Nitrate of ammonia, lb.	4,577,227	55,963
Cyanide of soda, lb.	1,986,008	3,219,417
Sodium nitrate, tons	109,064	159,275

Employment Contract for Chemists Is Suggested

Believing that a contract for the employment of chemists is desirable, the council of the American Institute of Chemists recently requested Lloyd Van Doren to make a study of the matter and to draw up a suitable form. The suggested outline embodies many points that have been arrived at after careful consideration of existing forms of professional contracts but is especially adapted to the requirements of chemists. This is intended mainly as a basis for discussion in arriving at a practical contract capable of general adoption. In an early issue of *Chem. & Met.* this proposed form will be published, together with the views that several leaders in the chemical profession hold on the matter.

Cyanide Production Progresses in California Plant

In his annual report to stockholders C. E. Adams, president of the Air Reduction Co., stated that in March, 1923, negotiations were completed with a certain group of men in southern California for the formation of the California Cyanide Co., Inc. A suitable plant site was obtained in Cudahy, Calif. The plant has been completed and, shortly before the end of the year, began production. It manufactures hydrogen cyanide and sodium and potassium cyanide. The company is using a process invented and developed in Air Reduction Co.'s laboratories.

Calendar

AMERICAN CHEMICAL SOCIETY, annual meeting. Washington, April 21 to 25.

AMERICAN ELECTROCHEMICAL SOCIETY, Hotel Bellevue-Stratford, Philadelphia, April 24 to 26.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Denver, Colo., July 15 to 18.

AMERICAN PAPER AND PULP ASSOCIATION, including T.A.P.P.I., Waldorf-Astoria, New York, April 7 to 11.

AMERICAN PAPER AND PULP MILL SUPERINTENDENTS ASSOCIATION, Dayton, May 22 to 24.

AMERICAN PHYSICAL SOCIETY, Washington, April 25 to 26.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Cleveland, Ohio, May 19 to 22.

AMERICAN SOCIETY FOR TESTING MATERIALS, Atlantic City, June 23 to 28.

CANADIAN INSTITUTE OF MINING AND METALLURGY, King Edward Hotel, Toronto, March 5 to 7.

NATIONAL ASSOCIATION OF PURCHASING AGENTS, Boston, May 19 to 24.

NATIONAL FIRE PROTECTION ASSOCIATION, annual meeting, Atlantic City, N. J., May 13 to 15.

PAPER INDUSTRIES EXPOSITION, New York, April 7 to 12.

Semet-Solvay Co. Moves Sales Force to New York

The general sales offices of the Semet-Solvay Co., of Syracuse, were moved to New York on March 1. O. S. Doolittle, formerly head of the New York office, was appointed general manager of the miscellaneous chemicals division. B. H. Handy and G. P. Spencer, who directed national sales of calcium chloride and salt at Syracuse, were transferred to the New York offices of Wing & Evans, and will continue in charge of this division. Spencer D. Embree, formerly assistant to Mr. Doolittle; L. J. Hicks and R. A. Scott, city salesmen, also joined the sales force of Wing & Evans.

Trade Associations May Give Statistical Information

Apparently the Department of Justice has no intention of attempting to call to account any trade association the only activity of which is the distribution of unidentified statistical information. It has been suggested that a judicial determination of a case involving such statistics only would be valuable in clearing up the uncertainty as to the legality of such activities. The Department of Justice, however, never has taken steps against an association engaged in what always has been considered thoroughly proper statistical activities. For that reason there has been no judicial decision covering the legality of such activities. The only way a judicial clarification of the situation can be secured would be through some process initiated by the Attorney-General. This he seems disinclined to do.

Trade Notes

William Zinsser, head of William Zinsser & Co., dealers in paints, oils, shellacs, etc., in New York City, sailed on March 1 for Europe on a combined business and pleasure trip.

The Easton Silk Dyeing & Finishing Co., at Easton, Pa., has sold its interests to the Valley Dye Works, Inc., a new corporation headed by Henry Dietz, of Paterson, N. J. The plant is located at Franklin and Peach Sts., and extensive improvements are planned throughout, after which the new company will continue operations as heretofore.

The Stroock & Wittenberg Corporation has been formed by A. J. Wittenberg, formerly with A. Klipstein & Co.; Samuel Stroock, formerly with S. Stroock & Co., and D. F. Moriarity, formerly with Innes & Co. Offices of the company are at 17 Battery Place, New York.

Arthur S. Somers, general manager of the Fred L. Lavenburg Co., manufacturer of dry colors, has been elected president of the Drug & Chemical Club of New York.

Dr. M. Mueller, president of the Rhodia Chemical Co., of New York, is abroad on an extended business trip.

Men You Should Know About

Dr. GALO W. BLANCO, formerly on the staff of the Forest Products Laboratory, Madison, Wis., is now chief chemist for the Riordon Pulp Corporation, Ltd., Hawkesburg, Ont.

C. B. DEAN of Leeds, England, asbestos and insulating engineer for the Turner Brothers Asbestos Co., Manchester, England, is on a visit to the United States in connection with expansion in the activities of the company in this country. He is making his headquarters at the Pennsylvania Hotel, New York.

Dr. CHARLES H. KIMBERLY and E. KENNETH BURGER have associated themselves as consultants in chemical engineering. They have established headquarters in New York City as the southeast corner of Liberty and Greenwich Sts.

Prof. W. H. MCADAMS of the Department of chemistry, Massachusetts Institute of Technology, Cambridge, Mass., spoke before the members of the Delaware Section of the American Chemical Society, Hotel du Pont, Wilmington, Feb. 20, on "Thermodynamics."

Dr. L. W. MCKEEHAN, of the research laboratories of the American Telephone & Telegraph Co. and Western Electric Co., Inc., New York City, spoke before the Franklin Institute, Feb. 28, on "Ferromagnetism and Its Dependence Upon Chemical, Mechanical and Thermal Conditions."

F. M. MOLSON, of Peoria, Ill., has been appointed general superintendent at the paper mills of the Barrett Manufacturing Co., Kingston, Latrobe, Pa. C. W. BISHOP will act as director of paper manufacture; and PAUL HILTON has been appointed chief engineer.

F. R. PALMER, of the Carpenter Steel Co., Reading, Pa., spoke before Washington Chapter of the American Society for Steel Treating, Feb. 15, on "Giving Steel Tools a Chance."

Dr. ALFRED R. POWELL, of the Koppers Co., has been transferred from Pittsburgh to Chicago, where he will be in charge of experimental work.

RONALD REAMER has taken a position as oil research chemist with the De Laval Separator Co. at Poughkeepsie, N. Y., in its experimental department. This company is planning a considerable extension of its research and investigation work and is establishing a chemical and physical testing laboratory and an oil refinery laboratory for studying the application of centrifugal machines and processes to oil refinery problems. Dr. A. E. FLOWERS is director.

D. WILLIAM SCAMMELL, of Trenton, N. J., has been elected president of the Scammell China Co., recently organized to take over the local pottery and business of the Maddock Lamberton Pottery Co. SCOTT SCAMMELL has been elected vice-president, FRANK H. SCAMMELL secretary, and MATHEW J. SCAMMELL treasurer.

Dr. RICHARD C. TOLMAN, professor of physical chemistry and mathematical physics at the California Institute of Technology, addressed the members of the Southern California Section of the American Chemical Society on Feb. 21, at the Institute, on "Newer Theories of the Rate of Chemical Reaction."

WARREN N. WATSON, chemical and dyestuff expert for the United States Tariff Commission, was one of the principal speakers at a meeting of the Synthetic Organic Chemical Manufacturers' Association, Hotel Commodore, New York, Feb. 15. FRANK B. GORIN, a like expert for the commission, also addressed the gathering.

G. H. WATZKE has been transferred from the East St. Louis Works to Fremont, Ohio, works of the National Carbon Co., in connection with the opening of the experimental flashlight cell manufacturing department with a capacity of 10,000 cells per day.

Dr. E. R. WEIDLEIN, director of the Mellon Institute of Industrial Research, Pittsburgh, Pa., was the principal speaker at a dinner of the Pittsburgh Foundrymen's Association, General Forbes Hotel, Feb. 18, giving an interesting address on "Scientific Research for Industry."

HOMER D. WILLIAMS, president of the Carnegie Steel Co.; TAYLOR ALLDERDICE, vice-president of the National Tube Co., and Dr. JOHN C. BOWMAN, chancellor of the University of Pittsburgh, all of Pittsburgh, Pa., have been elected members of the board of directors of the Bethlehem Laboratories, Inc., of that city, specializing in the production of "Hyclorite" and other compounded products.

Dr. W. COURTNEY WILSON, formerly research chemist for the Cutler-Hammer Co. of Milwaukee, Wis., has joined the research staff of the Miner Laboratories, where he will be engaged in the development of derivatives of furfural.

LEONARD A. YERKES, president of the Cellophane Co. and the du Pont Fibre Silk Co., both of Buffalo, N. Y., has been elected a director of the parent organization, E. I. du Pont de Nemours & Co., Wilmington, Del. He will succeed J. A. Haskell, recently deceased, on the board.

Obituary

RICHARD TRIMBLE of New York, for many years secretary and treasurer of the United States Steel Corporation, died Feb. 17, aged 66 years. He was graduated from Harvard University in 1880, and was associated with the late J. Pierpont Morgan in the organization of the Steel Corporation. He resigned from the office noted in 1922 on account of ill health. He was a director in several other iron and steel corporations.

Paper Industries Show Coming April 7 to 12

Second Exposition in New York to Include Broad Range of Exhibits

Plans for the 1924 Paper Industries Exposition, to be held in Grand Central Palace during the week of April 7, indicate that the second annaul show is to be fully up to the standard established last year. Practically all of the exhibitors that took space last year have taken at least an equal amount again this year. The main floor of the Palace is to be used instead of an upper floor as was the case in 1923. The space is being subdivided into sections, with the machinery, supply, chemical and equipment houses segregated into their respective groups. Paper and paper products are to be arranged in a group in the center of the floor.

Arrangements are already actively under way for a special program at the exposition by the Technical Association of the Pulp and Paper Industry, which will hold its annual convention during Paper Week. A program of particular interest to both technical engineers in the paper industry and the machinery and supply men is being formulated by W. G. MacNaughton, Secretary of T.A.P.P.I., which is one of the biggest technical organizations in the country of engineers in a special branch of industry.

A noteworthy feature of the space contracts that are being placed is the number of firms making paper products which will be represented. The space assigned to the makers of paper specialties is already overflowing, and among the displays of this group will be some of the most striking features of the exposition. Paper cups, boxes and bags form a small part of this department, which will be one of the most popular phases of the big paper show for the general public.

In the paper machinery and supplies group advance information as to the type of exhibits indicates that there will be even a larger proportion than last year that will have operating machinery as a feature of their booths. The value of the exposition as a means of working with the paper mill executives is not being overlooked by the big chemical companies, which have learned from experience that the exposition method is a most satisfactory one for the demonstration of products and for getting in contact with the paper mills that use their materials.

A daily motion picture program will be part of the week's "Paper Show" and a list of films pertaining to paper manufacture, woods operations of paper companies, the production of specialties, and general forestry will be included.

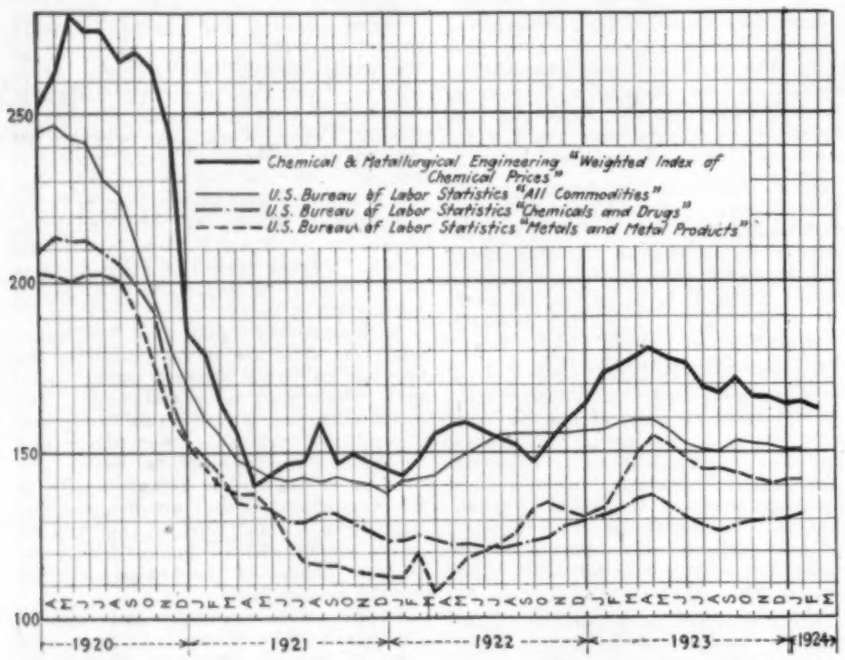
The management of the exposition has stood firm on its policy of devoting part of the space to educational purposes for the benefit of the general public, and on this account some desirable space has been withdrawn from sale. Educational institutions, government departments and others interested in various phases of the paper problem will be represented in the educational department of the exposition.

Call for Chemicals Is Better in February

Consuming Industries Are Working Into Better Position—Weighted Index Number Lower

While definite figures are not available for comparison of the output of chemical products in February with the totals for the preceding month and for February, 1923, it is generally held that production was on a smaller scale than a year ago. Many of the more important materials are sold ahead in large quantities but call for additional lots has not been heavy enough to encourage expansion at producing points.

The position of large consuming industries is of prime importance in production and distribution of chemicals.



Employment figures compiled by the Department of Labor show decreases in the number of workers in many industries, the comparison being between January 1924 and January 1923. Percentages of decrease, which may be construed as approximate decreases in production, were: dyeing and finishing 19 per cent; leather 8.1 per cent; paper and pulp 0.7 per cent; fertilizers 2 per cent; petroleum refining 3.8 per cent; glass 4.2 per cent; and automobile tires 16.8 per cent. The situation is more reassuring when comparison is made between January 1924 and December 1923. In the latter case the fertilizer trade shows a gain of 1.5 per cent over December, the leather trade an increase of 0.3 per cent, and automobile tires expanded 3.9 per cent.

Overseas trade in chemicals has continued to gain in volume. Latest official figures are for January and indicate that exports were nearly 10 per cent larger than in December and far outstripped the totals for January 1923. Imports of chemicals likewise were large, surpassing in volume and valuation importations of December and of January 1923. A major part of present imports consists of products which are given free entry into this country.

Chem. & Met.'s weighted index number fixes the average value of chemical products for February at 163.16 which compares with an average of 164.80 for the preceding month. A review of the various items which fluctuated in price during the month reveals that advances were as common as declines and the establishment of a lower weighted number was the result of lower levels for a few commodities which carry relatively high weighted influence rather than because of any marked downward trend to values in general. Among the chemicals which were advanced in price were liquid chlorine and bleaching powder. These materials were conspicuous in the latter half of 1923 because of the price war which existed among sellers and the higher price schedules of last month, following an upward revision early in January, gave proof that this branch of the industry had been restored to a normal condition of marketing.

The U. S. Bureau of Labor in its report on prices for 404 commodities for January finds no change from the preceding month, the index number being 151 for each month. Chemicals and drugs, however, are found at higher levels, the numbers being 132 for January and 130 for December. Metals were in close harmony with the all commodity list and showed no change, the index standing at 142 for both December and January.

Developments during the month, with reference to possible modifications or changes in duties, were confined to a hearing before the Tariff Commission on Feb. 14, at which a reduction in duty on cresylic acid was discussed. Opposition to any change in the present duty was expressed by prominent producers of coal-tar products and it was brought out that the home output of cresylic acid is increasing and one company which produced 150,000 gal. in 1921 expected to turn out 750,000 gal. in the current year.

Financial

The annual report of Sidney Blumenthal & Co., Inc., operator of the Shelton Looms, shows net income of $1,143,803 for the year ended Dec. 31, 1923.

The B. F. Goodrich Co. in the last calendar year showed net profits of $3,025,383 after interest and depreciation but before federal taxes.

A net loss of $38,998 is reported by the American Hide & Leather Co. for the year ended Dec. 31. This compares with net profit of $1,035,153 in 1922.

The Texas Gulf Sulphur Co. has declared an extra dividend of 25c. and regular quarterly dividend of $1.50 per share, both payable March 15.

E. I. du Pont de Nemours & Co., of Wilmington, Del., will call for redemption on May 1 $10,000,000 of its ten-year gold 7½ per cent bonds, which were issued to the extent of $35,000,000 in May, 1921. There were outstanding $28,164,500 on Feb. 4 last.

Directors' meeting of Virginia-Carolina Chemical Co. was adjourned last Thursday, without a quorum. It is stated the company will not relinquish the cottonseed products end of the business.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	77⅜	77
Allied Chem. & Dye	68½	67½
Allied Chem. & Dye pfd	113½	112
Am. Ag. Chem.	12⅜	11⅜
Am. Ag. Chem. pfd	38	34½
American Cotton Oil c'f's	11	12
American Cyanamid	*91	*103
Am. Drug Synd.	5⅛	5
Am. Linseed Co.	18⅜	18½
Am. Linseed pfd	40	38
Am. Smelting & Refining Co.	61⅜	59
Am. Smelting & Refining pfd.	99	99
Archer-Daniels Mid. Co. w.i.	26	25
Archer-Daniels Mid. Co. pfd.	88	87
Atlas Powder	52	52
Casein Co. of Am.	*65	*65
Certain-Teed Products	29⅛	29
Commercial Solvents "A"	52⅛	51
Corn Products	177½	174
Corn Products pfd.	118	118½
Davison Chem.	49½	55½
Dow Chem. Co.	*45	*45
Du Pont de Nemours	128	128½
Du Pont de Nemours db	86½	86½
Freeport-Texas Sulphur	10¼	10
Grasselli Chem.	*125	*125
Grasselli Chem. pfd.	*100	*100
Hercules Powder	*104	*104
Hercules Powder pfd.	*103	*104½
Heyden Chem.	2	2
Int'l Ag. Chem. Co. (new)	4⅞	*3½
Int'l Ag. Chem. pfd.	6½	5½
Int'l Nickel	13¾	12⅞
Int'l Nickel pfd.	79	78½
Int'l Salt	89½	89
Mathieson Alkali	33⅜	34
Merck & Co.	*59	*63
National Lead	140	138
National Lead pfd.	114	112½
New Jersey Zinc	*148	*148
Parke, Davis & Co.	80	80
Pennsylvania Salt	86	86
Procter & Gamble	*130	*130
Sherwin-Williams	30½	30
Sherwin-Williams pfd.	*100½	*100
Tenn. Copper & Chem.	9	8⅝
Texas Gulf Sulphur	63½	63
Union Carbide	62	61½
United Drug	81¼	*79
United Dyewood	40	*40
U. S. Industrial Alcohol	75	74⅞
U. S. Industrial Alcohol pfd.	101	101
Va.-Car. Chem. Co.	7¼	1¼
Va.-Car. Chem. pfd.	23	13⅜

*Nominal. Other quotations based on last sale.

Market Conditions

Downward Trend of Arsenic Prices Features Trading in Chemicals

Slow Call for Calcium Arsenate a Bearish Factor— Contract Withdrawals and Export Buying Account for Steady Movement of Chemicals

TRADING in chemicals and allied products in the spot market continues along narrow lines. Deliveries of various selections against contracts are of large volume and buying for export is satisfactory. A freer movement of fertilizers was reported last week but several consuming trades are backward and are not taking raw materials in as large a way as had been expected.

Special attention is attracted to white arsenic because of the steadily declining tendency of prices. Import statistics show that arrivals from foreign centers have been large but consumers of calcium arsenate in the South have been backward and this has slowed up demand for arsenic and values have weakened accordingly. Trade authorities hold that current prices are too low to hold if buying should begin in an active way but admit that values may recede further if demand does not become more active.

The weighted index number for the week advanced to 162.74 as against 162.19 for the preceding week. Price changes, however, were narrow and strength in crude cottonseed oil aided in bringing up the average price level. It is noted that most of the imported chemicals were in a fairly steady position though some foreign selections continue to sell under the parity of competing domestic offerings.

Buying for export covers a wide range of materials but the totals are large and official figures for January indicate a gain of nearly 10 per cent in the value of exports of chemical products as compared with totals for December. Imports, likewise, are large but preference is given to materials which are not subject to import tariffs.

Acids

Arrivals of tartaric acid from foreign producing centers were heavy last week and a good proportion of this material was sold ahead, but spot offerings were increased and prices eased off slightly with quotations at 27@27½c. per lb. Citric acid was moving freely and was held at 47½@48c. per lb. for imported and 48@49c. per lb. for domestic. Formic acid also is firmly held with domestic out of line and imported receiving the call at 13½@14c. per lb. Lactic acid is fairly free from competition and is reported to be finding an outlet in various industries. The dark 22 per cent is offered at 4½@5c. per lb. and the light 22 per cent at 5½@6c. per lb. Mineral acids show a gradual improvement but stocks of most grades are large and on desirable business, sellers will deal on private terms.

Potashes

Bichromate of Potash—In spite of the fact that some large consumers are not active, the market for bichromate appears to be in a firm position.

Further Declines in Arsenic—Calcium Arsenate Lower—Copper Sulphate Irregular—Caustic Potash Firm in All Positions — Formaldehyde Strong and More Active—Sal Ammoniac Steady — Nitrate of Soda in Better Demand

Stocks are well controlled and production is said to be in proportion to consumption. Some producers are reported to be disposing of seasonable amounts both for home and export. Prices are steady at 9⅝@9¾c. per lb.

Caustic Potash—Cables from foreign points have indicated firm markets abroad and the lowest price heard for shipments was 6½c. per lb. Spot material also was strongly held and asking prices ranged from 6½c. per lb. upward, according to seller. While domestic production is at a standstill, there are stocks on hand which are offered at 7c. per lb., at works, in carlots.

Chlorate of Potash — There is not much call for spot chlorate as large buyers are covered on contract. Holdings on spot are small and prices are on a steady basis with 7@7½c. per lb. asked. Domestic chlorate is offered freely but is quoted at 8½c. per lb. and demand is slow.

Cyanide of Potash—There is nothing new in this chemical. Trading is quiet but is seasonal. Values are quoted at 60@65c. per lb.

Permanganate of Potash—Moderate business in domestic permanganate is reported but the imported material is practically neglected. Prices for imported are little better than nominal in the absence of actual trading. Producers of domestic permanganate are taking business at 14@14½c. per lb., at works, with freight allowances.

Prussiate of Potash—Red prussiate meets with only occasional demand and buyers generally refuse to operate unless they secure concessions from the quoted levels of 45c. per lb. Yellow prussiate was very quiet last week. Holders of imported were asking 20c. per lb. on spot but there was not enough interest to test the stability of that figure. Shipment prices were given at 18@18½c. per lb. with no business reported.

Sodas

Soda Ash—Trading in spot material has been slow and the buyers of less than carlots are not much in evidence. Contract deliveries are of good volume and exports also are fairly large. No changes in price are anticipated as values appear to be well established. The quotation for contracts on light ash 58 per cent, carlots at works is $1.25 per 100 lb. in bulk; $1.38 per 100 lb. in bags, and $1.63 per 100 lb. in bbl. Spot and nearby from works are offered at 5c. per 100 lb. above the contract figures.

Acetate of Soda—There is not much resale acetate offered but competition among producers is keen enough to keep prices unsettled and quotations show a range according to seller. Some good sized orders have been placed recently but stocks in sellers' hands are still large and asking prices of 5c. to 5½c. per lb. for carlots are heard.

Bichromate of Soda—Unsold stocks are said to have decreased and some sellers are offering sparingly. Total movement from works is said to be less than a year ago but production has been adjusted accordingly and the tone to prices is firm. Open quotations range from 7½c. to 8c. per lb. according to quantity. Export demand is not active but there is a regular movement to different foreign markets.

Caustic Soda—The quotation for export is maintained at an inside figure of $3 per 100 lb., f.a.s. New York. This price applies to the so-called standard and outside brands. Exports continue to reach a large total but are smaller in volume than at this time last year. There is no change in the situation as referred to the domestic trade. Contract price remains at $3.10 per 100 lb. in carlots at works. Spot and prompt from works command a premium of 10c. per 100 lb. over the contract price.

Cyanide of Soda—One of the features of this market is the fact that both imports and exports of cyanide have been large. Imports in January were 3,219,417 lb. as against 1,986,008 lb. in January. Exports in January were 1,906,086 lb. as compared with 81,408 lb. for the corresponding month last year. Different prices are heard for imported grades depending on grade and seller. Domestic grades of standard make are held at 22c. per lb.

Nitrate of Soda—According to cables from Chile, exports of nitrate from there in January were 3,052,192 metric quintals, which is the largest figure for that month since January, 1920. Exports for the first 15 days of February were 1,178,887 metric quintals. It is also stated that while demand in the first half of February was quiet, there were inquiries for large amounts in the latter part of the month. Official figures place imports into the United States in January at 159,275 tons as against 109,064 tons in January, 1923. The position of domestic markets has not changed during the week. Spot material is quoted at $2.45@$2.50 per 100 lb., depending on location with the inside figure referring to southern points.

Prussiate of Soda—A quiet week was reported. Domestic producers are eager to compete with imported and domestic prussiate is held at 12@13c. per lb. Imported was offered at 11½c. per lb. on spot and at 11¼c. per lb. for shipment.

Miscellaneous Chemicals

Arsenic—Imports of white arsenic in January amounted to 1,925,486 lb. as compared with 1,879,639 lb. in the corresponding period of 1923. The fact that imports are heavy and buying by domestic consumers is slow has a depressing effect on values. Further reductions in price have been made in the spot market and offerings were available last week at 11½c. per lb. Shipments also were lower and 11c. per lb. was quoted for prompt from Japan. Calcium arsenate also was lower and was available at 10¾c. per lb. at works.

Bleaching Powder — Producers continue to quote $1.75 per 100 lb. for drums, carlots at works. Demand is quiet due to competition from liquid chlorine and to the fact that many buyers of bleach are covered ahead. In quoting liquid chlorine a correction has been made in the schedule as previously announced and the quotation is placed at $6.50 per 100 lb. in cylinders, for sales of 1 ton or less. In tanks the asking price is $4 per 100 lb. at works, and cylinders, carlots, are offered at $5 per 100 lb.

Copper Sulphate—The market price for domestic sulphate is irregular as some producers have advanced quotations to $4.75 per 100 lb. whereas others are willing to sell at $4.50 per 100 lb. at works. Sales were recorded at the inside level during the past week. Imported sulphate was offered at $4.40 per 100 lb. on spot and at $4.30 per 100 lb. for shipment. While imported sulphate is a factor in domestic markets it is noted that exports from this country reached a total of 487,046 lb. in January as compared with 377,922 lb. in January, 1923.

Formaldehyde — Sales of less than carlots were made at 11½c. per lb. and the inside quotation of 11c. per lb. is confined strictly to carlots. Demand has been better and predictions of higher prices are heard.

Sal Ammoniac—Buying orders have reduced holdings in the spot market and asking prices have shown a tendency to harden. A few lots on spot were offered during the week at 6¾c. per lb. but in most quarters 6¾c. per lb. was asked. Shipment prices also were firm and 6½c. per lb. was the lowest figure heard for goods afloat and for prompt from foreign ports.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	162.74
Last week	162.19
Mar., 1923	178.00
Mar., 1922	156.00
Mar., 1921	157.00
Mar., 1920	252.00
Mar., 1919	233.00
Mar., 1918	281.00

The higher market for domestic copper sulphate and crude cottonseed oil caused the index number to advance 55 points in the past week.

Alcohol

The movement of denatured alcohol into consuming channels against existing contracts has been large enough to absorb the bulk of the output and with no change in the position of raw materials the undertone continues to favor sellers. No price changes were announced by first hands despite the firm tone of the market. On the No. 5 completely denatured the nominal quotation on carload lots stood at 44½c. per gal., drums extra.

A better undertone than has lately existed featured the methanol market. Demand has picked up a little, but the real cause of the improved feeling could be traced to the recent curtailment in production. Pure methanol, in tank cars, works, closed the week at 90c. per gal.

Coal-Tar Products

Good Inquiry for Benzene, Toluene and Xylene—Phenol Firm—Crude Naphthalene Unsettled Abroad—Intermediates Inactive

DEMAND for coal-tar crudes was fairly active and a firm undertone featured the market. Few producers were in a position to quote on prompt shipment material, the output in most directions being contracted for as far ahead as May. Inquiry developed for toluene and xylene for nearby delivery. The spot situation in phenol underwent little if any change, supplies being limited to rather small lots for which dealers asked a premium. Refined naphthalene was steady in anticipation of the seasonal buying which usually sets in within the next month or so. In crude naphthalene the market was barely steady because of rather liberal offerings of supplies for shipment from abroad. The arrival of several shipments of crude naphthalene from the United Kingdom and the Continent was reported during the week. Cresylic acid was available at unchanged prices, although traders were less inclined to force business. The market for intermediates, taken as a whole, was inactive.

Aniline Oil and Salt—Demand was described as normal and, with stocks light, a firm undertone prevailed so far as producers were concerned. Aniline oil for immediate and nearby shipment held at 16c. per lb., drums extra, carload basis. Aniline salt was available at 23c. per lb.

Benzaldehyde—Competition between first hands has been more of a factor of late and the market during the week was barely steady. On the technical grade there were offerings around 70c. per lb.

Benzene—Demand for the motor fuel grades was good. The call for the 90 per cent and pure grades also was satisfactory and the market rules firm in all quarters. Leading producers maintained prices on the basis of 23c. per gal. for the 90 per cent grade, and 25c. per gal. for the pure, tank cars, f.o.b. works.

Beta-Naphthol — Producers are asking 25@26c. per lb. for the technical material, the price varying according to quantity. With no important change in basic materials the market was considered steady.

Cresylic Acid — The market for cresylic acid was barely steady, but no open change in prices was reported. Some traders regarded the situation as firmer on nearby stuff, but others stood ready to shade prices in order to attract buyers. Quotations heard ranged from 65c. to 75c. per gal., depending upon the quality and seller. Manchester reported dull trading in 60 per cent cresylic as buyers' views are holding around 1s. 9d. per gal., with sellers not disposed to trade under 2s. 3d. per gal., works.

Naphthalene—Flake naphthalene for prompt shipment was steady at 6½@6¾c. per lb., according to quantity and seller, but on contract prices were quotably unchanged at 6@6¼c. per lb., carload basis. A little more buying interest was reported in the spot market. Chips held at 5@5¼c. per lb., prompt and nearby delivery, with trading described as routine only. Crude for shipment from abroad was barely steady at 2¼c. per lb., c.i.f. basis.

Phenol — Small parcels of U.S.P. phenol in drums sold during the week at 36@37c. per lb. Producers had nothing to offer except to regular customers and prices in the outside market were little more than nominal. On contract the market for phenol was nominally unchanged around 28c. per lb. The bulk of the production is going into the manufacture of phenolic resins.

Solvent Naphtha—A firm tone featured the market as demand has been sufficient to absorb production. Quotations held on the basis of 25c. per gal., for the water white, tank cars, works.

Toluene—There was a steady call for toluene for March-April delivery and, according to traders, buyers had no easy time to locate supplies. The market was quotably unchanged at 26c. per gal., tank cars, works, with the undertone quite firm.

Xylene — Business was reported in commercial quality xylene at 28c. per gal., in tanks, f.o.b. works. Demand has picked up within the past week or so and production no longer is burdensome.

Vegetable Oils and Fats

Cottonseed Steadies After Decline—Linseed Oil Unsettled—China Wood Under Pressure—Palm and Rapeseed Oils Firmer

PRICES for vegetable oils were irregular. Consuming industries bought sparingly and, in most instances, refused to extend operations into the forward positions. Interest centered in the action of the market for refined cottonseed oil, the options on the Produce Exchange establishing new lows in the nearby positions. Cottonseed oil steadied a little towards the close on supporting orders from refiners. Linseed oil was dull and prices could have been shaded on a bid. China wood oil sold at lower prices. Lagos palm oil advanced to higher cables from Liverpool. There was good inquiry for nearby rapeseed oil and higher prices were asked towards the close. Sesame oil was easy. Tallow and greases held about steady on moderate offerings. There was no change in the market for fish oils.

Cottonseed Oil—Wednesday was first tender day for March refined oil and the 4,300 bbl. delivered uncovered a few weak spots in the option market. The current month sold down to 9.88c. per lb., a new low for the movement. On the decline refiners bought rather freely and this restored confidence in speculative quarters, steadying the market considerably. Late in the week it was generally thought that liquidation in March was about over and the speculative element was inclined to hold off from playing the bear side pending developments in connection with actual consumption of oil. The lard market did not move much one way or the other, but it was understood that packers were bullish. The showing made by cottonseed oil since the beginning of the season has not been good, high prices restricting consumption. Traders hope for business to pick up at prevailing levels. Lard compound in the past week was inactive, with prices more or less nominal at 12@12¼c. per lb., carload basis. Crude cottonseed oil settled at 8¾c. per lb., tank cars, Texas, and 9c. per lb., tank cars, Southeast and Valley, with offerings moderate at all times.

Linseed Oil—There was no improvement in the demand and, with a slightly easier market for seed, prices towards the close were barely steady. Most crushers held out for 94c. per gal., carload lots, cooperage basis, nearby positions, and 91c. per gal. for May forward, but it was admitted that both of these figures could have been shaded on a firm bid, on round lots. In fact March oil did sell at 93c. per gal. during the week. Actual consumption of linseed oil has shown no increase compared with a year ago and in more than one direction it is felt that the distribution in this country for 1924 may not be any larger than last year. A short time ago crushers were figuring on an increase in consumption for the entire year of something like 10 per cent. The statistical position of the market for flaxseed favors oil buyers and this accounts, to a large extent, for the inactive state of the market on futures. Developments in the Northwest are receiving more consideration and, in the event of a substantial increase in the acreage, lower prices for flaxseed should obtain this summer. Stocks of seed at Minneapolis are placed at 323,000 bu., against 5,832 bu. a year ago. Stocks at Duluth amount to approximately 200,000 bu., while the holdings at the Canadian terminals were officially reported at 738,000 bu. The market for prompt shipment cake was steady at $41 per ton, f.a.s. N. Y. On March shipment nominal quotations for cake range from $37@$38 per ton, with May forward at $33 per ton.

Argentine Flaxseed Exports

Shipments of flaxseed from the Argentine for the period beginning with Jan. 1, and ended Feb. 21, show a gain of 2,054,000 bu. compared with the corresponding period a year ago. The shipments, according to countries, follow:

	1924 Bu.	1923 Bu.
United Kingdom	1,916,000	792,000
Continent	6,182,000	4,584,000
Australia	140,000	184,000
United States	3,560,000	3,864,000
On orders	2,348,000	2,668,000
Total	14,146,000	12,092,000

China Wood Oil—Business was reported on the Pacific coast at 17c. per lb., tank cars, a decline of ¾c. On May forward it was intimated that 16¾c. might be done, tank car basis, coast. Offerings increased, while demand was anything but active. In New York the market for oil in cooperage settled around 18½@18¾c. per lb.

Coconut Oil—No important business was placed, either here or in the West. Ceylon type oil was offered at 8¼c. per lb., sellers' tank cars, f.o.b. San Francisco, all positions. In New York 8¼c. was asked by first hands for prompt shipment oil. Refined coconut oil, in cooperage, spot, settled at 11c. per lb. nominal.

Olive Oil—Denatured olive oil sold at prices ranging from $1.25@$1.30 per gal., with the undertone firm. The short crop has resulted in smaller offerings from Italy. Prime green olive oil foots on spot held firm at 10½c. per lb., with futures nominal at 9¾@10c. per lb. Some consumers of foots are now taking red oil.

Palm Oils—Lagos oil for shipment advanced to 8c. per lb., which compares with 7.85c. a week ago. Niger settled at 7c. per lb., all positions. There was moderate improvement in trading.

Rapeseed Oil—Spot refined oil was in demand and the nominal quotation at the close stood around 88c. per gal. May-Aug. shipment from the other side sold at 82c. per gal.

Other Oils—Sesame oil was offered for shipment from abroad at 11½c. per lb., c.i.f. N. Y. No. 1 castor oil was available for shipment from England at 15c. per lb., cooperage basis. Crude peanut oil was nominally unchanged at 12½c. per lb., mills, Southeast. Crude soya bean oil unchanged at 10c. per lb., tank cars, duty paid, f.o.b. Pacific coast ports.

Tallow, Etc.—About a week ago business went through in extra special tallow at 8c. per lb., ex plant. The market held at this figure up to the close, with the undertone firmer. Yellow grease was in good demand and firm at 7c. per lb. on low acid material. English pale degras steady at 5¾c. per lb., with dark German and Belgian available at 3¾@4c. per lb. Oleo stearine quiet at 9¾c. per lb., carload basis.

Miscellaneous Materials

Antimony—Supplies are in firm hands and the market continues at 11@11½c. per lb. for Chinese and Japanese. Advices from the Orient report a strong situation in nearby shipment material. Cookson's "C" grade was raised in the past week to 14½c. per lb. Antimony oxide, white, 99 per cent guaranteed, held at 9@9½c. per lb.

Blanc Fixe—On carload business there were sellers of dry blanc fixe for immediate shipment at 3¾c. per lb. For less than carload lots nominal quotations held at 4@4½c. per lb.

Casein—Demand quiet and prices unsettled. Imported casein, technical, duty paid, offered at 12@12½c. per lb.

Dry Colors—Competition keen and prices unsettled. Chrome yellow, chemically pure, offered at 17c., with a possibility of shading this figure on a round lot. Chrome green, light, offered at 28@30c. per lb. Prussian blue nominal at 40c. per lb. Paris green held at 31c. by producers, but this figure could have been shaded in open market. For goods in cooperage, ex plant, 26c. could have been done.

Glycerine—Last sales of crude soap lye, basis 80 per cent, reported at 10½c. per lb., loose, an advance of ¼c. Saponification crude nominal at 11¾c. per lb., loose. Dynamite steady at 15½c., with recent sales in the West at 15¼c. per lb. Chemically pure unchanged at 16½c. per lb., in drums, carload lots, f.o.b. N. Y., and 16c. per lb. in Chicago.

White Lead—There was an advance of ¼c. per lb. in all of the lead pigments, reflecting the strength in the metal. Corroders now quote standard dry white lead, basic carbonate, at 10c. per lb., in casks, carload lots. Demand has been good, notwithstanding the recent uplift in prices. With prospects for lower lead for the near future not favorable the undertone of the market on pigments was firm at the advance. Pig lead continues strong, leading interests quoting the metal at 8.70c. per lb., New York. In the outside market the metal sold at 9c. per lb., New York, March delivery.

Zinc Oxide—Rubber manufacturers have been more active, but business in the paint field has been only fair. Producers of zinc oxide regard the situation as firm, pointing to the steadier position of the metal. American process, commercially lead free, held at 7¼c. per lb., carload basis. French process, red seal, was unchanged at 9¾c. per lb., carload basis.

Imports at the Port of New York

February 21 to February 28

ACIDS—Cresylic—1 dr., Liverpool, W. E. Jordan & Bros.; 40 dr., Liverpool, E. H. Watson; 15 dr., Glasgow, Order. **Citric**—1150 csk., Palermo, Order. **Oxalic**—64 bbl., Hamburg, Roessler & Hasslacher Chemical Co.; 31 bbl., Rotterdam, Guaranty Trust Co. **Tartaric**—100 csk., Marseilles, Brown Bros. & Co.; 150 bbl. and 50 keg., Rotterdam, W. Benkert & Co.; 150 csk., Rotterdam, Chemical National Bank; 525 csk., Palermo, Order; 100 csk., Rotterdam, Order. **Stearic**—30 cs., Rotterdam, M. W. Parsons—Plymouth Organic Lab.

ALCOHOL—2 dr. amyl., London, Order; 1 bbl. butyl, Havre, Order; 59 csk. butylic, Bordeaux, Commercial Solvent Corp.

ALUMINA HYDRATE—58 csk., Hamburg, A. Hurst & Co.; 450 bg., Rotterdam, R. W. Greeff & Co.

AMMONIUM CARBONATE — 10 csk., Liverpool, J. Turner & Co.; 30 csk., Liverpool, Brown Bros. & Co.

ANILINE OIL—2 dr., Barcelona, Order.

ANTIMONY OXIDE—75 csk., London, Order; 200 bbl., Havre, Heemsoth, Basse Co.

ANTIMONY REGULUS—200 pkg., Antwerp, Order; 30 csk., London, Order; 307 cs., Genoa, Order; 500 cs., Hankow, F. A. Cundill & Co.; 500 cs., Hankow, Columbia Salvage Co.; 500 cs., Hankow, Nassau Smelting & Refining Co.

ANTIMONY SULPHIDE—25 csk., London, L. H. Butcher & Co.; 10 csk., Antwerp, L. H. Butcher & Co.

ANTIMONY—250 cs. crude, Shanghai, Harshaw, Fuller & Goodwin; 716 bg. ore, Antofagasta, W. R. Grace & Co.

ARSENIC—49 csk., Antwerp, Schulz & Ruckgaber; 122 bbl., Tampico, American Smelting & Refining Co.; 30 csk., Bordeaux, J. Munroe & Co.

ASBESTOS — 218 bg., London, Irving Bank-Col. Trust Co., 1,250 bg. crude, London, W. D. Crumpton & Co.

BARIUM CHLORIDE—79 csk., Rotterdam, E. Suter & Co.; 68 csk., Rotterdam, F. L. Goldschmidt Corp.

BARYTES—950,000 kilos, Rotterdam, Ore & Chemicals Corp.

BLEACHING POWDER—150 cs., Liverpool, H. Kahnstamm & Co.

BRONZE POWDER — 20 cs., Bremen, Gerstendorfer Bros.; 14 cs., Bremen, B. F. Drakenfeld & Co.; 16 cs., Hamburg, J. E. Mandle.

CARBON BLACK—20 bbl., Havre, Stanley, Daggett Co.

CASEIN—383 bg., Bordeaux, Equitable Trust Co.

CHALK—750 bg. and 66 bbl., Antwerp, L. A. Salomon & Bros.; 500 bg., Antwerp, Order; 2,100 bg., Antwerp, Brooklyn Trust Co.; 150 bg., Antwerp, E. M. Sergeant & Co.; 500 bg., Antwerp, Order; 310 pkg. precipitated, Bristol, H. J. Baker & Bros.

CHEMICALS—16 csk., Havre, G. Leuders & Co.; 140 dr., London, J. W. Hampton & Co.; 620 bg., Glasgow, Brown Bros & Co.; 143 dr., Antwerp, Roessler & Hasslacher Chemical Co.; 20 cs., Hamburg, H. Lieher & Co.; 29 pkg., Hamburg, Fuchs & Lang Mfg. Co.; 132 pkg., Hamburg, Jungmann & Co.; 16 bbl., Hamburg, Hummel & Robinson; 40 bbl. compounds, Hamburg, Order; 400 bg., Glasgow, Brown Bros. & Co.; 300 csk., Marseilles, Pomeroy & Fischer; 12 cs., Bremen, Roessler & Hasslacker Chemical Co.; 100 bbl., Rotterdam, Chemical National Bank; 65 csk., Rotterdam, Roessler & Hasslacker Chemical Co.; 20 cs. coal-tar intermediates, Rotterdam, H. A. Metz Laboratories.

CITRATE LIME—169 csk., Messina, C. Pfizer & Co.

COAL-TAR DISTILLATE — 140 dr., Liverpool, Order; 61 dr., Glasgow, Order.

COLORS — 10 csk., Havre, Reichard-Coulston, Inc.; 40 cs. dry, London, R. F. Downing & Co.; 250 bg. blue, Hull, Reckitts, Ltd.; 9 bbl. aniline, Genoa, Bank of the Manhattan Co.; 2 csk. aniline, Rotterdam, Carbic Color & Chem. Co.; 5 csk. do., Rotterdam, Grasselli Chemical Co.; 3 pkg. do., Rotterdam, H. A. Metz & Co.; 68 csk. do., Rotterdam, Bank of the Manhattan Co.; 19 csk. do., Rotterdam, Kuttroff, Rickhardt & Co.; 6 csk. do., Rotterdam, G. A. Kuhl; 5 csk. do., Rotterdam, Earle & Co.; 13 pkg. coal-tar, Liverpool, American Cellulose Co.; 14 csk. aniline, Genoa, Irving Bank-Col. Trust Co.; 24 pkg. do., Rotterdam, Kuttroff, Pickhardt & Co.; 7 csk. do., Rotterdam, Color Service Co.; 2 pkg. do., Rotterdam, Am. Exchange Nat'l Bank; 28 pkg. do., Rotterdam, H. A. Metz & Co.; 7 pkg. do., Hamburg, Franklin Import & Export Co.; 12 csk. do., Hamburg, H. A. Metz & Co.; 12 csk. dry, Hamburg, Kuttroff, Pickhardt & Co.

COPPER SULPHATE—100 csk., Antwerp, Order.

CREAM TARTAR—60 csk., Hamburg, Order.

CREOSOTE—4,226 tons (bulk), Antwerp, American Creosoting Co.

DIVI-DIVI—300 bg., Curacao, E. J. Haley, Inc.

FULLERS EARTH—100 bg., London, L. A. Salomon & Bros.; 250 bg., Bristol, L. A. Salomon & Bros.

FUSEL OIL—18 dr., Antwerp, Order.

GAMBIER—397 cs., Singapore, L. Littlejohn & Co.

GLYCERINE—133 dr. crude, Antwerp, Order; 70 csk. crude, Bordeaux, Order.

GRAPHITE—500 bg. amorphous, Genoa, Order.

GUMS—151 cs. kauri, Auckland, Guaranty Trust Co.; 294 bg. do., Auckland, Brown Bros. & Co.; 4 cs. do., Auckland, Worham, Bates & Goode Trading Corp.; 67 cs. do., Auckland, Order; 503 bg. copal, Antwerp, Order; 14 bg. do., London, S. Winterbourne & Co.; 75 cs. copal and 50 cs. damar, Singapore, Chemical National Bank; 50 cs. damar and 128 bg. do., Singapore, L. C. Gillespie & Sons; 50 cs. copal, Singapore, Brown Bros. & Co.; 100 bg. copal, Manila, Chartered Bank of India, Australia and China; 15 bg. copal, Liverpool, Order.

IRON CHLORIDE—44 csk., Liverpool, Phillip Bros.

IRON OXIDE—45 csk., Hull, J. Lee Smith & Co.; 25 bbl., Malaga, East River National Bank; 57 bbl., Malaga, Reichard-Coulston, Inc.; 228 bbl., Malaga, American Exchange Nat'l Bank; 228 bbl., Malaga, C. J. Osborn & Co.; 233 bbl., Malaga, C. K. Williams & Co.; 70 bbl., Malaga, Scott, Libby Corp.; 30 bbl., Malaga, Order; 142 csk., Liverpool, Reichard-Coulston, Inc.; 29 csk., Liverpool, Order.

LAMP BLACK—4 csk., Antwerp, S. L. Libby Corp.; 40 csk., Antwerp, F. B. Vandegrift & Co.

LEAD SULPHATE—5 csk., Antwerp, Dwight & Lloyd Metallurgical Co.

LIME—505 bg., Hamburg, Order.

LITHOPONE—439 csk., Antwerp, B. Moore & Co.; 250 csk., Antwerp, E. M. & F. Waldo; 200 csk., Antwerp, A. Klipstein & Co.; 40 csk., Rotterdam, L. H. Butcher & Co.; 100 csk., Rotterdam, Reichard-Coulston, Inc.

MAGNESIUM CHLORIDE — 68 csk., Hamburg, Order; 72 dr., Hamburg, A. Kramer & Co.

MAGNESITE—225 bbl., Rotterdam, Innis, Speiden & Co.; 104 bbl. and 313 bg., Rotterdam, Speiden, Whitefield Co.

MINERAL WHITE—100 bg., Hull, Whittaker, Clarke & Daniels.

NAPHTHALENE—1,657 bg., Antwerp, Order; 647 bg., Rotterdam, Lunham & Reeve; 225 bg., Bristol, Order.

OCHER—286 csk., Marseilles, Reichard-Coulston, Inc.; 37 csk., Marseilles, Am. Exchange Nat'l Bank; 120 csk., Marseilles, J. Lee Smith & Co.; 42 csk., Marseilles, Am. Exchange Nat'l Bank; 18 csk., Marseilles, J. Lee Smith & Co.; 100 csk., Marseilles, R. J. Waddell & Co.; 18 csk., Marseilles, L. H. Butcher & Co.

OILS—Cod—50 csk., St. Johns, Order. **Coconut**—890 tons, Manila, Spencer Kellogg & Sons. **China Wood**—50 dr., Hong Kong, International Trust Co.; 56 dr., Hong Kong, Order; 290 csk., Hankow, Brown Bros. & Co. **Fish**—60 bbl., Rotterdam, Lunham & Reeve. **Grape**—5 cs., Rotterdam, Pickfords Colonial, Inc. **Linseed**—29 bbl., London, International Composition Co.; 90 dr., Rotterdam, W. Van Doorn. **Olive foots** (sulphur oil)—20 puns., Seville, Philadelphia National Bank; 1,000 bbl., Bari, Order; 250 bbl., Malaga, National City Bank; 150 bbl., Malaga, Bank of the Manhattan Co.; 100 bbl., Palermero, Order. **Palm**—30 bbl., Liverpool, Order; 46 csk., Rotterdam, Grace Bros. & Co.; 458 csk., Hamburg, African & Eastern Trading Co. **Palm kernel**—18 csk., Antwerp, Philadelphia National Bank; 200 bbl., Hull, Order. **Peanut**—100 bbl., Antwerp, Order; 289 csk., Bordeaux, Am. Shipping Co. **Rapeseed**—250 bbl., Hull, Order. **Sesame**—120 bbl., Genoa, Order; 152 bbl., Liverpool, Order; 200 bbl., Bristol, Order; 140 bbl., Rotterdam, J. C. Francesconi & Co.; 200 bbl., Rotterdam, Ellis Jackson & Co. **Whale**—22,000 bbl., South Georgia, Procter & Gamble.

OIL SEEDS—Castor—1,696 bg., Paramaribo, Order. **Linseed** — 60,175 bg., Rosario, Order; 1,547,912 kilos (bulk) and 24,501 bg., Rosario, Order; 6,040 tons, Rosario, Order.

PHOSPHATE—1,060 bg., Antwerp, E. Suter & Co.; 810 bg., Antwerp, Order.

POTASSIUM SALTS—400 csk. chlorate, Antwerp, Chemico Electrometallurgical Products Trading Corp.; 6,000 bg. muriate, Bremen, Potash Importing Corp. of America; 5,140 bg. muriate, Antwerp, Societe Commerciale des Potasses d'Alsace; 560,000 kilos muriate, Dunkirk, Societe Commerciale des Potasses d'Alsace; 453,605 kilos manure salt, Hamburg, Potash Importing Corp. of Am.; 250 bbl. alum, Hamburg, Order; 69 cs. caustic, Gothenburg, Mallinckrodt Chemical Works; 40 keg bicarbonate, Bristol, Order.

SAL AMMONIAC—27 bbl., Hamburg, Brown Bros. & Co.; 200 csk., Bristol, C. de P. Field Co.

SHELLAC—113 bg., Hamburg, Kasebier-Chatfield Shellac Co.; 70 bg., Hamburg, Irving Bank-Col. Trust Co.; 300 bg., Hamburg, Order; 86 cs., Bankok, Order; 26 cs., Rotterdam, C. F. Gerlach.

SODIUM SALTS—168 cs. cyanide, Havre, Asia Banking Corp.; 20 bg. pyrophosphate, Havre, F. E. Wallach; 83 csk. hyposulphite, Antwerp, Order; 7,223 bg. nitrate, Iquique, Wessel, Duval & Co.; 4,035 bg. do., Iquique, Anthony Gibbs & Co.; 322 csk. phosphate, Antwerp, National Silk Dying Co.; 38 csk. prussiate, London, H. Kohnstamm & Co.; 9 cs. caustic, Gothenburg, Mallinckrodt Chemical Works; 175 bbl. soda, Gothenburg, E. M. Sergeant & Co.; 2,674 bg. nitrate, Iquique, W. R. Grace & Co.; 442 csk. hyposulphite, Marseilles, Order; 42 csk. prussiate, Liverpool, C. Tennant Sons & Co.; 15 csk., Rotterdam, H. Kohnstamm & Co.; 80 csk. hydrosulphite, Rotterdam, Kuttroff, Pickhardt & Co.; 120 csk. silicate, Rotterdam, Innis, Speiden & Co.

SUMAC—1,800 bg. ground, Palermo, Order; 200 bbl. leaf, Palermo, Order.

TALC—120 bg., Marseilles, J. Mitchell; 1,000 bg., Genoa, Italian Discount & Trust Co.; 100 bg., Genoa, C. Mathieu; 1,050 bg., Bordeaux, Hammill & Gillespie; 1,200 bg., Bordeaux, Whittaker, Clark & Daniels; 500 bg., Genoa, Italian Discount & Trust Co.

TARTAR—295 bg., Marseilles, Tartar Chemical Works; 105 bg., Marseilles, C. Pfizer & Co.; 110 csk., Marseilles, Brown Bros. & Co.; 180 bg., Buenos Aires, Tartar Chemical Works; 42 bg., Genoa, Order; 115 bg. and 104 cs., Naples, Tartar Chemical Works; 416 sk., Marseilles, C. Pfizer & Co.; 210 sk., Marseilles, Tartar Chemical Works; 489 bg., Bordeaux, American Express Co.; 45 bg., Bordeaux, Kidder, Peabody & Co.

VANADIUM ORE — 1,192 bg., Callao, Vanadium Corp. of America; 6,000 bg., Callao, Vanadium Corp. of America.

VERMILION—10 csk., London, Pomeroy & Fischer; 2 cs., London, C. H. Powell Co.

WAXES—100 pkg. beeswax, Havana, Order; 35 bg. beeswax, Matanzas, D. Steengrafe; 17 bg. do., Valparaiso, L. Luxardo & Co.; 65 bg. do., Antwerp, Guaranty Trust Co.; 266 bg. paraffine, London, Smith & Nichols; 77 bg. beeswax, Lisbon, J. H. Schroeder; 84 bg. ozokerite, Trieste, Order; 1,000 bg. montan, Hamburg, Irving Bank-Col. Trust Co.; 25 bg. beeswax, Havana, Order.

WOOL GREASE—25 bbl., Hamburg, Schneider Bros.; 20 csk., Bremen, G. Kuhlman; 30 bbl., Hamburg, Schneider Bros.

ZINC OXIDE—65 bbl., Antwerp, Phillipp Bros.; 100 csk., Antwerp, E. M. & F. Waldo; 10 cs., London, Order; 100 csk., Marseilles, F. B. Vandegrift & Co.

ZINC WHITE — 60 bbl. Marseilles, Reichard-Coulston, Inc.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks.	lb.	$0.19 – $0.19½
Acetic anhydride, 85%, dr.	lb.	.38 – ....
Acid, acetic, 28%, bbl.	100 lb.	3.38 – 3.63
Acetic, 56%, bbl.	100 lb.	6.75 – 7.00
Acetic, 80%, bbl.	100 lb.	9.58 – 9.83
Glacial, 99½%, bbl.	100 lb.	12.00 – 12.78
Boric, bbl.	lb.	.10 – ....
Citric, kegs	lb.	.46½– .48
Formic, 85%	lb.	.13½– .13¾
Gallic, tech.	lb.	.45 – .50
Hydrofluoric, 52%, carboys	lb.	.11 – .12
Lactic, 44%, tech., light, bbl.	lb.	.11½– .12
22% tech., light, bbl.	lb.	.05½– .06
Muriatic, 18° tanks	100 lb.	.90 – 1.00
Muriatic, 20°, tanks	100 lb.	1.00 – 1.10
Nitric, 36°, carboys	lb.	.04½– .05
Nitric, 42°, carboys	lb.	.05½– .05½
Oleum, 20%, tanks	ton	16.00 – 17.00
Oxalic, crystals, bbl.	lb.	.10½– .11
Phosphoric, 50% carboys	lb.	.07½– .08½
Pyrogallic, resublimed	lb.	1.55 – 1.60
Sulphuric, 60°, tanks	ton	9.00 – 10.00
Sulphuric, 60°, drums	ton	13.00 – 14.00
Sulphuric, 66°, tanks	ton	14.00 – 15.00
Sulphuric, 66° drums	ton	19.00 – 20.00
Tannic, U.S.P., bbl.	lb.	.65 – .70
Tannic, tech., bbl.	lb.	.45 – .50
Tartaric, imp., powd., bbl.	lb.	.27 – .27½
Tartaric, domestic, bbl.	lb.	.30 – ....
Tungstic, per lb.	lb.	1.20 – 1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.45 – .47
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.85 – ....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.81 – ....
Alcohol, methyl (see Methanol)		
Alcohol, denatured, 190 proof		
No. 1, special bbl.	gal.	.51½– ...
No. 1, 190 proof, special, dr.	gal.	.45½– ...
No. 1, 188 proof, bbl.	gal.	.52½– ...
No. 1, 188 proof, dr.	gal.	.48½– ...
No. 5, 188 proof, bbl.	gal.	.50½– ...
No. 5, 188 proof, dr.	gal.	.44½– ...
Alum, ammonia, lump, bbl.	lb.	.03½– .04
Potash, lump, bbl.	lb.	.02½– .03½
Chrome, lump, potash, bbl.	lb.	.05½– .06
Aluminum sulphate, com., bags	100 lb.	1.40 – 1.50
Iron free bags	lb.	2.40 – 2.50
Aqua ammonia, 26°, drums	lb.	.06½– .06¾
Ammonia, anhydrous, cyl.	lb.	.28 – .30
Ammonium carbonate, powd. tech., casks	lb.	.10 – .10½
Ammonium nitrate, tech., casks	lb.	.09 – .10
Amyl acetate tech., drums	gal.	4.50 – 4.75
Antimony oxide, white, bbl.	lb.	.09 – ....
Arsenic, white, powd., bbl.	lb.	.11½– .12
Arsenic, red, powd., kegs	lb.	.15 – .15½
Barium carbonate, bbl.	ton	63.00 – 68.00
Barium chloride, bbl.	ton	82.00 – 88.00
Barium dioxide, 88%, drums	lb.	.17½– .18
Barium nitrate, casks		.08 – .08½
Blanc fixe, dry, bbl.	lb.	.03½– .04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.75 – ....
Spot N. Y. drums	100 lb.	2.10 – ....
Borax, bbl.	lb.	.05½– .05½
Bromine, cases	lb.	.28 – .30
Calcium acetate, bags	100 lb.	4.00 – 4.05
Calcium arsenate, dr.	lb.	.11 – .11½
Calcium carbide, drums	lb.	.05 – .05½
Calcium chloride, fused, dr. wks.	ton	21.00 – ....
Gran. drums works	ton	27.00 – ....
Calcium phosphate, mono, bbl.	lb.	.06½– .07
Camphor, cases	lb.	.78 – .79
Carbon bisulphide, drums	lb.	.06 – .06½
Carbon tetrachloride, drums	lb.	.08 – .08½
Chalk, precip.—domestic, light, bbl.	lb.	.04½– .04½
Domestic, heavy, bbl.	lb.	.03½– .04
Imported, light, bbl.	lb.	.04½– .05
Chlorine, liquid, tanks, wks.	lb.	.04 – .04¼
Contract, tanks, wks.	lb.	.04 – ....
Cylinders, 100 lb., wks.	lb.	.05 – .06½
Cylinders, 100 lb., spot	lb.	.08½– .09
Chloroform, tech., drums	lb.	.30 – .32
Cobalt, oxide, bbl.	lb.	2.10 – 2.25
Copperas, bulk, f.o.b. wks.	ton	16.00 – 18.00
Copper carbonate, bbl.	lb.	.17 – .17½
Copper cyanide, drums	lb.	.45 – .46
Copper sulphate, dom., bbl.	100 lb.	4.65 – 4.75
Imp bbl.	100 lb.	4.40 – 4.50
Cream of tartar bbl.	lb.	.22½– .23
Epsom salt, dom., tech., bbl.	100 lb.	1.75 – 2.00
Epsom salt, imp., tech., bags	100 lb.	1.05 – 1.10
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.25 – 2.50
Ether, U.S.P., dr.	lb.	.14 – .15
Ethyl acetate, 85%, drums	gal.	1.10 – ....
Ethyl acetate, 99%, dr.	gal.	$1.25 – ....
Formaldehyde, 40%, bbl.	lb.	.11 – .11½
Fullers earth—f.o.b. mines	ton	18.00 – 20.00
Furfural, works, bbl.	lb.	.25 – ....
Fusel oil, ref., drums	gal.	3.50 – ....
Fusel oil, crude, drums	gal.	2.50 – 3.00
Glaubers salt, wks., bags	100 lb.	1.20 – 1.40
Glaubers salt, imp., bags	100 lb.	.95 – 1.05
Glycerine, c.p., drums extra	lb.	.16½– .17
Glycerine, dynamite, drums	lb.	.15½– ....
Glycerine, crude 80%, loose	lb.	.10½– ....
Hexamethylene, drums	lb.	.70 – .75
Lead: White, basic carbonate, dry, casks	lb.	.10 – ....
White, basic sulphate, casks	lb.	.09½– ....
White, in oil, kegs	lb.	.12 – ....
Red, dry, casks	lb.	.11¼– ....
Red, in oil, kegs	lb.	.13 – ....
Lead acetate, white crys., bbl.	lb.	.14½– ....
Brown, broken, casks	lb.	.13½– ....
Lead arsenate, powd., bbl.	lb.	.18 – .20
Lime-Hydrated, bg. wks.	ton	10.50 – 12.50
Bbl., wks.	ton	18.00 – 19.00
Lime, Lump, bbl.	280 lb.	3.63 – 3.65
Litharge, comm., casks	lb.	.11½– ....
Lithopone, bags	lb.	.06½– .06¾
Magnesium carb., tech., bags	lb.	.08½– .08½
Methanol, 95%, bbl.	gal.	.93 – ....
Methanol, 97%, bbl.	gal.	.95 – ....
Methanol, pure, tanks	gal.	.90 – ....
drums	gal.	1.00 – ....
bbl.	gal.	1.05 – ....
Methyl-acetone, t'ks.	gal.	1.05 – 1.10
Nickel salt, double, bbl.	lb.	.10 – .10½
Nickel salts, single, bbl.	lb.	.10½– .11
Orange mineral, cak	lb.	.14½– .15
Phosgene		.60 – .75
Phosphorus, red, cases	lb.	.70 – .75
Phosphorus, yellow, cases	lb.	.35 – .40
Potassium bichromate, casks	lb.	.09½– .09¾
Potassium bromide, gran., bbl.	lb.	.19 – .20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½– .06¾
Potassium chlorate, powd.	lb.	.07½– .08½
Potassium cyanide, drums	lb.	.47 – .52
Potassium, first sorts, cask	lb.	.08½– .08¾
Potassium hydroxide (caustic potash) drums	lb.	.06½– .06¾
Potassium iodide, cases	lb.	3.65 – 3.75
Potassium nitrate, bbl.	lb.	.07½– .09
Potassium permanganate, drums	lb.	.14 – .14¼
Potassium prussiate, red, casks	lb.	.45 – .48
Potassium prussiate, yellow, casks	lb.	.20 – .20½
Salammoniac, white, gran., casks, imported	lb.	.06½– .06¾
Salammoniac, white, gran., bbl., domestic	lb.	.07½– .07¾
Gray, gran., casks	lb.	.08 – .09
Salsoda, bbl.	100 lb.	1.20 1.40
Salt cake (bulk) works	ton	21.00 – ....
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 – ....
bags, contract	100 lb.	1.38 – ....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 – ....
bags, contract	100 lb.	1.45 – ....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 – ....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 – 3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	3.00 – ....
Sodium acetate, works, bbl.	lb.	.05 – .05½
Sodium bicarbonate, bulk	100 lb.	1.75 – ....
330-lb. bbl.	100 lb.	2.00 – ....
Sodium bichromate, casks	lb.	.07½– .07¾
Sodium bisulphate (niter cake)	ton	6.00 – 7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½– .04¾
Sodium chlorate, kegs	lb.	.06½– .07
Sodium chloride	long ton	12.00 – 13.00
Sodium cyanide, cases	lb.	.19 – .22
Sodium fluoride, bbl.	lb.	$0.09 – $0.10½
Sodium hyposulphite, bbl.	lb.	.02½– .02¾
Sodium nitrite, casks	lb.	.08 – .08½
Sodium peroxide, powd., cases	lb.	.28 – .30
Sodium phosphate, dibasic, bbl.	lb.	.03½– .03¾
Sodium prussiate, yel. bbl.	lb.	.11½– .12
Sodium salicylic, drums	lb.	.40 – .42
Sodium silicate (40°, drums)	100 lb.	.75 – 1.15
Sodium silicate (60°, drums)	100 lb.	1.75 – 2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03½– .03½
Sodium sulphite, crys., bbl.	lb.	.03½– .03¾
Strontium nitrate, powd., bbl.	lb.	.10 – .10½
Sulphur chloride, yel drums	lb.	.04½– .05
Sulphur, crude	ton	18.00 – 20.00
At mine, bulk	ton	16.00 – 18.00
Sulphur, flour, bag	100 lb.	2.25 – 2.35
Sulphur, roll, bag	100 lb.	2.00 – 2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 – .08
Tin bichloride, bbl.	lb.	.14 – .14¼
Tin oxide, bbl.	lb.	.55 – ....
Tin crystals, bbl.	lb.	.35½– .36
Zinc carbonate, bags	lb.	.14 – .14½
Zinc chloride, gran, bbl.	lb.	.05 – .05½
Zinc cyanide, drums	lb.	.36½– .37
Zinc dust, bbl	lb.	.08½– .08¾
Zinc oxide, lead free, bag	lb.	.07½– ....
5% lead sulphate, bags	lb.	.07½– ....
10 to 35 % lead sulphate, bags	lb.	.07 – ....
French, red seal, bags	lb.	.09½– ....
French, green seal, bags	lb.	.10½– ....
French, white seal, bbl.	lb.	.12 – ....
Zinc sulphate, bbl.	100 lb.	2.75 – 3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 – $0.65
Alpha-naphthol, ref., bbl.	lb.	.65 – .80
Alpha-naphthylamine, bbl.	lb.	.35 – 36
Aniline oil, drums	lb.	.16 – .16½
Aniline salts, bbl.	lb.	.22 – .23
Anthracene, 80%, drums	lb.	.75 – .80
Anthracene, 80%, imp., drums, duty paid	lb.	68 – .72
Anthraquinone, 25%, paste, drums	lb.	.75 – .80
Benzaldehyde U.S.P., carboys	lb.	1.50 – ....
f.f.c. drums	lb.	1.60 – ....
tech, drums	lb.	70 ....
Benzene, pure, water-white, tanks, works	gal.	.25 – ....
Benzene, 90%, tanks, works	gal.	.23 – ....
Benzidine base, bbl.	lb.	.80 – .84
Benzidine sulphate, bbl.	lb.	.72 – .75
Benzoic acid, U.S.P., kegs	lb.	.83 – 86
Benzoate of soda, U.S.P., bbl.	lb.	.65 – .70
Benzyl chloride, 95-97%, ref., carboys	lb.	.40 – ....
Benzyl chloride, tech., drums	lb.	.25 – ....
Beta-naphthol, tech., bbl.	lb.	.25 – .26
Beta-naphthylamine, tech.	lb.	.75 – .80
Cresol, U.S.P., drums	lb.	.25 – .29
Ortho-cresol, drums	lb.	.28 – .32
Cresylic acid, 97%, works drums	gal.	.70 – .73
95-97%, drums, works	gal.	.65 – .68
Dichlorbenzene, drums	lb.	.06 – .08
Diethylaniline, drums	lb.	.53 – .55
Dimethylaniline, drums	lb.	.38 – .39
Dinitrobenzene, bbl.	lb.	.18 – .20
Dinitrochlorbenzene, bbl.	lb.	.21 – .22
Dinitronaphthalen, bbl.	lb.	.30 – .32
Dinitrophenol, bbl.	lb.	.35 – .40
Dinitrotoluen, bbl.	lb.	.20 – .22
Dip oil, 25%, drums	gal.	.28 – .30
Diphenylamine, bbl.	lb.	.50 – .52
H-acid, bbl.	lb.	.70 – .75
Meta-phenylenediamine, bbl.	lb.	.95 – 1.00
Michlers ketone, bbl.	lb.	3.00 – 3.50
Monochlorbenzene, drums	lb.	.08 – .10
Monoethylaniline, drums	lb.	.95 – 1.10
Naphthalene, flake, bbl.	lb.	.06 – .06½
Naphthalene, balls, bbl.	lb.	.07 – .07½
Naphthionate of soda, bbl.	lb.	.60 – .65
Naphthionic acid, crude, bbl.	lb.	.55 – .60
Nitrobenzene, drums	lb.	.09 – .09½
Nitro-naphthalene, bbl.	lb.	.30 – .35
Nitro-toluene, drums	lb.	.13½– .14
N-W acid, bbl.	lb.	1.05 – 1.10
Ortho-amidophenol, kegs	lb.	2.30 – 2.35
Ortho-dichlorbenzene, drums	lb.	.15 – .17
Ortho-nitrophenol, bbl.	lb.	1.20 – 1.30
Ortho-nitrotoluene, drums	lb.	.11 – .12
Ortho-toluidine, bbl.	lb.	.13 – .14
Para-amiñophenol, base, kegs	lb.	1.30 – ....
Para-amiñophenol, HCl, kegs	lb.	1.55 – ....
Para-dichlorbenzene, bbl.	lb.	.17 – .20
Paranitraniline, bbl.	lb.	.68 – .70
Para-nitrotoluene, bbl.	lb.	.58 – .60
Para-phenylenediamine, bbl.	lb.	1.45 – 1.50
Para-toluidine, bbl.	lb.	.88 – .90
Phthalic anhydride, bbl.	lb.	.30 – .34
Phenol, U.S.P., dr.	lb.	.28 – .36
Picric acid, bbl.	lb.	.20 – .22
Pyridine, dom., drums	gal.	nominal
Pyridine, imp., drums	gal.	3.25 – 3.50
Resorcinol, tech., kegs	lb.	1.40 – 1.50

Resorcinol, pure, kegs	lb.	$2.15 –	....
R-salt, bbl.	lb.	.55 –	.60
Salicylic acid, tech., bbl.	lb.	.33 –	....
Salicylic acid, U.SP., bbl.	lb.	.35 –	....
Solvent naphtha, water-white, tanks	gal.	.25 –	....
Crude, tanks	gal.	.22 –	....
Sulphanilic acid, crude, bbl.	lb.	.18 –	.20
Thiocarbanilide, kegs	lb.	.35 –	.38
Tolidine, bbl.	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.26 –	....
Toluene, drums, works	gal.	.30 –	....
Xylidine, drums	lb.	.50 –	....
Xylene, pure, tanks	gal.	.40 –	....
Xylene, com., tanks	gal.	.28 –	....

Naval Stores

Rosin B-D, bbl. 280 lb.		$5.80 –	.....
Rosin E-I, bbl. 280 lb.		5.85 –	.....
Rosin K-N, bbl. 280 lb.		6.10 –	$6.80
Rosin W.G.-W.W., bbl. 280 lb.		7.65 –	7.85
Wood rosin, bbl. 280 lb.		5.80 –	5.90
Turpentine, spirits of, bbl.	gal.	1.02 –	.....
Wood, steam dist., bbl.	gal.	.88 –	.....
Wood, dest. dist., bbl.	gal.	.70 –	.....
Pine tar pitch, bbl. 200 lb.		5.50 –	.....
Tar, kiln burned, bbl. 500 lb.		11.00 –	.....
Retort tar, bbl. 500 lb.		11.00 –	.....
Rosin oil, first run, bbl.	gal.	.43 –	.....
Rosin oil, second run, bbl.	gal.	.47 –	.....
Rosin oil, third run, bbl.	gal.	.50 –	.....
Pine oil, steam dist.	gal.	.60 –	.62
Pine oil, pure, dest. dist.	gal.	.55 –	.....
Pine tar oil, ref.	gal.	.35 –	.....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla.	gal.	.30 –	.....
Pine tar oil, double ref., bbl.	gal.	.70 –	.....
Pinewood creosote, ref., bbl.	gal.	..... –	.52

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½ –	$0.05½
Grease, yellow, loose	lb.	.07 –	.07½
Lard oil, Extra No. 1, bbl.	gal.	.85 –	.....
Neatsfootoil 20 deg. bbl.	gal.	1.30 –	.....
No. 1, bbl.	gal.	.88 –	.92
Oleo Stearine	lb.	.09½ –	.....
Oleo oil, No. 1, bbl.	lb.	.14½ –	.....
Red oil, distilled, d.p. bbl.	lb.	.08½ –	.08¾
Saponified, bbl.	lb.	.08½ –	.08¾
Tallow, extra, loose	lb.	.08 –	.....
Tallow oil, acidless, bbl.	gal.	.86 –	.....

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.15 –	.....
Castor oil, No. 1, bbl.	lb.	.15½ –	.....
Chinawood oil, bbl.	lb.	.18½ –	.19
Coconut oil, Ceylon, bbl.	lb.	.10 –	.....
Ceylon, tanks, N.Y.	lb.	.08¾ –	.....
Coconut oil, Cochin, bbl.	lb.	.10½ –	.10¾
Corn oil, crude, bbl.	lb.	.12 –	.....
Crude, tanks, (f.o.b. mill)	lb.	.09½ –	.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½ –	.09
Summer yellow, bbl.	lb.	.10½ –	.10¾
Winter yellow, bbl.	lb.	.11½ –	.12
Linseed oil, raw, car lots, bbl.	gal.	.93 –	.....
Raw, tank cars (dom.)	gal.	.87 –	.....
Boiled, cars, bbl. (dom.)	gal.	.95 –	.....
Olive oil, denatured, bbl.	gal.	1.25 –	1.30
Sulphur, (foots) bbl.	lb.	.10½ –	.....
Palm, Lagos, casks	lb.	.08 –	.....
Niger, casks	lb.	.07 –	.....
Palm kernel, bbl.	lb.	.09½ –	.....
Peanut oil, crude, tanks (mill)	lb.	.12½ –	.....
Peanut oil, refined, bbl.	lb.	.14½ –	.15½
Perilla, bbl.	lb.	.14½ –	.15
Rapeseed oil, refined, bbl.	gal.	.88 –	.....
Sesame, bbl.	lb.	.11½ –	.....
Soya bean (Manchurian), bbl.	lb.	.12 –	.....
Tank, f.o.b. Pacific coast	lb.	.10 –	.....
Tank, (f.o.b. N.Y.)	lb.	.10¼ –	.....

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.65 –	$0.67
Menhaden, light pressed, bbl.	gal.	.62 –	.....
White bleached, bbl.	gal.	.64 –	.....
Blown, bbl.	gal.	.68 –	.....
Crude, tanks (f.o.b. factory)	gal.	.47½ –	.....
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.79

Oil Cake and Meal

Coconut cake, bags	ton	$32.00 –	....
Cottonseed meal, f.o.b. mills	ton	40.00 –	....
Linseed cake, bags	ton	41.00 –	....
Linseed meal, bags	ton	43.00 –	....

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 –	$0.55
Albumen, egg, tech, kegs	lb.	.95 –	.97
Cochneal, bags	lb.	.32 –	.34
Cutch, Borneo, bales	lb.	.04½ –	.04¾
Cutch, Rangoon, bales	lb.	.13½ –	.14½
Dextrine, corn, bags 100 lb.		3.64 –	3.69
Dextrine, gum, bags 100 lb.		3.99 –	4.09
Divi-divi, bags	ton	39.00 –	40.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.11 –	.11½
Logwood, sticks	ton	25.00 –	26.00
Logwood, chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	90.00 –	.....
Sumac, ground, bags	ton	$85.00 –	$90.00
Sumac, domestic, bags	ton	40.00 –	42.00
Starch, corn, bags 100 lb.		3.02 –	3.12
Tapioca flour, bags	lb.	.05½ –	.06½

Extracts

Archil, conc., bbl.	lb.	$0.16½ –	$0.20
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl.	lb.	.04 –	.05
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.09½ –	.09¾
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½ –	.04
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl.	lb.	.09½ –	.10½
Logwood, crys., bbl.	lb.	.14 –	.15
Logwood, liq., 51°, bbl.	lb.	.08 –	.09
Quebracho, solid, 65% tannin, bbl.	lb.	.05 –	.05½
Sumac, dom., 51°, bbl.	lb.	.06½ –	.07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.07½ –	$0.09
spot, cases	lb.	.11 –	.15
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl.	lb.	.40 –	.43
Prussian, bbl.	lb.	.40 –	.43
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.06 –	.14
Sienna, Domestic, bbl.	lb.	.03½ –	.04
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens–Chrome, C.P. Light, bbl.	lb.	.28 –	.30
Chrome, commercial, bbl.	lb.	.12 –	.12½
Paris, bulk	lb.	.26 –	.28
Reds, Carmine No. 40, tins	lb.	4.50 –	4.70
Iron oxide red, casks	lb.	.10 –	.16
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl.	lb.	1.15 –	1.20
Yellow, Chrome, C.P. bbls.	lb.	.16½ –	.17½
Ocher, French, casks	lb.	.02½ –	.03

Waxes

Bayberry, bbl.	lb.	$0.25 –	$0.26
Beeswax, crude, Afr. bg.	lb.	.22 –	.22½
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.23 –	.23½
Carnauba, No. 1, bags	lb.	.36 –	.38
No. 2, North Country, bags	lb.	.21 –	.21½
No. 3, North Country, bags	lb.	.18½ –	.19
Japan, cases	lb.	.19½ –	.20½
Montan, crude, bags	lb.	.05½ –	.06
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.05 –	....
Crude, scale 124-126 m.p. bags	lb.	.04½ –	.04¾
Ref., 118-120 m.p., bags	lb.	.04½ –	....
Ref., 123-125 m.p., bags	lb.	.05 –	....
Ref, 128-130 m.p., bags	lb.	.05½ –	....
Ref., 133-135 m.p., bags	lb.	.05½ –	....
Ref., 135-137 m.p., bags	lb.	.05½ –	....
Stearic acid, agle pressed, bags	lb.	.11½ –	....
Double pressed, bags	lb.	.12 –	....
Triple pressed, bags	lb.	.13½ –	.13½

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$8.00 –	$8.25
Ammonium sulphate, bulk f.o.b. works 100 lb.		2.85 –	.....
Blood, dried, bulk	unit	4.10 –	4.15
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	..... –	.....
Nitrate of soda, bags 100 lb.		2.45 –	2.50
Tankage, high grade, f.o.b. Chicago	unit	3.30 –	3.40
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	4.00 –	4.50
Tennessee, 78-80%	ton	7.75 –	8.00
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	45.85 –	.....
Double manure salt	ton	27.00 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.20½ –	.....
Upriver coarse	lb.	.17 –	.....
Upriver caucho ball	lb.	.19 –	.....
Plantation—First latex crepe	lb.	.25 –	.....
Ribbed smoked sheets	lb.	.25½ –	.....
Brown crepe, thin, clean	lb.	.24½ –	.....
Amber crepe No. 1	lb.	.25 –	.....

Gums

Copal, Congo, amber, bags	lb.	$0.10 –	$0.15
East Indian, bold, bags	lb.	.20 –	.21
Manila, pale, bags	lb.	.19 –	.20
Pontinak, No. 1 bags	lb.	.19 –	.20
Damar, Batavia, cases	lb.	.23 –	.....
Singapore, No. 1, cases	lb.	.31 –	.32
Singapore, No. 2, cases	lb.	.21½ –	.22
Kauri, No. 1, cases	lb	.64 –	.66
Ordinary chips, cases	lb.	.20½ –	.21½
Manjak, Barbados, bags	lb.	.08 –	.11

Shellac

Shellac, orange fine, bags	lb.	$0.59 –	....
Orange superfine, bags	lb.	.61 –	....
A. C. garnet, bags	lb.	.56 –	....
Bleached, bonedry	lb.	.67 –	.68
Bleached, fresh	lb.	.55 –	....
T. N., bags	lb.	.56 –	.57

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$300.00 –	$400.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	50.00 –	70.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 –	25.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	16.00 –	17.00
Barytes, grd., off-color, f.o.b. Balt.	net ton	13.00 –	14.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	23.00 –	24.00
Barytes, crude f.o.b. mines, bulk	net ton	8.00 –	8.50
Casein, bbl., tech.	lb.	.12 –	.12½
China clay (kaolin) crude, No. 1, f.o.b. Ga.	net ton	7.00 –	8.00
Washed, f.o.b. Ga.	net ton	8.50 –	9.00
Powd., f.o.b. Ga.	net ton	13.00 –	20.00
Crude f.o.b. Va.	net ton	6.00 –	8.00
Ground, f.o.b. Va.	net ton	13.00 –	19.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.50 –	7.00
No. 2 f.o.b. N.C.	long ton	4.50 –	5.00
No. 1 soap	long ton	7.00 –	.....
No. 1 Canadian, f.o.b. mill, powd.	long ton	20.00 –	.....
Graphite, Ceylon, lump, first quality, bbl.	lb.	.05½ –	.06
Ceylon, chip, bbl.	lb.	.04½ –	.05
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.11½ –	.11¾
Gum tragacanth, sorts, bags	lb.	.50 –	.55
No. 1, bags	lb.	1.35 –	1.40
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N.Y.	ton	50.00 –	55.00
Magnesite, crude, f.o.b. Cal.	ton	14.00 –	15.00
Pumice stone, imp., casks	lb.	.03 –	.05½
Dom., lump, bbl.	lb.	.05 –	.05½
Dom., ground, bbl.	lb.	.05 –	.06
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind.	ton	2.25	3.50
Silica, amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 –	.....
Silica, glass sand, f.o.b. Ill.	ton	1.75 –	3.00
Soapstone, coarse, f.o.b. Vt., bags	ton	7.50 –	8.00
Tale, 200 mesh, f.o.b., Vt., bags, extra	ton	9.50 –	.....
Tale, 200 mesh, f.o.b. Ga., bags	ton	8.50 –	9.00
Talc, 325 mesh, f.o.b. New York, grade A bags	ton	14.75 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$4.00 –	$4.50
Corning	bbl.	1.95 –	.....
Cabell	bbl.	2.05 –	.....
Somerset	bbl.	2.15 –	2.35
Illinois	bbl.	1.92 –	.....
Indiana	bbl.	1.93 –	.....
Kansas and Okla. under 30 deg.	bbl.	1.15 –	.....
California, 35 deg. and up	bbl.	1.40 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls.	gal.	$0.20 –	.....
Naphtha, V. M. & P. deod, steel bbls	gal	.19 –	.....
Kerosene, ref. tank wagon	gal.	.15 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.09 –	.....
Lubricating oils:			
Cylinder, Penn., dark	gal.	.21½ –	.22
Bloomless, 30@31 grav.	gal.	.18 –	.....
Paraffin, pale	gal.	.17 –	.17½
Spindle, 200, pale	gal.	.21 –	.21½
Petrolatum, amber, bbls.	lb.	.03½ –	.04½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145
Chrome brick, f.o.b. Eastern shipping points	ton	45–47
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3 sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42–45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35–38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	50–53
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	50–53
F.o.b. Mt. Union, Pa.	1,000	42–45
Silicon carbide refract. brick, 9-in.	1,000	1180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 – .....

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.30 -.....
4-6% C	lb.	.10½-.....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	109.00 -.....
Spiegeleisen, 19-21% Mn	gr. ton	38.00 - 40.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 - 2.50
Ferrosilicon, 10-12%	gr. ton	41.50 - 46.50
50%	gr. ton	75.00 - 80.00
Ferrotungsten, 70-80%, per lb. of W	lb.	.85 - .90
Ferro-uranium, 35-50% o U per lb. of U	lb.	4.50 -.....
Ferrovanadium, 30-40% per lb. of V	lb.	3.50 - 4.00

Ores and Semi-finished Products

Bauxite, dom. crushed dried, f.o.b. shipping points	ton	$5.50 - $8.75
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 - 23.00
C.i.f. Atlantic seaboard	ton	19.50 - 22.00
Coke, fdry., f.o.b. ovens	ton	5.25 - 5.75
Coke, furnace, f.o.b. ovens	ton	4.25 - 4.50
Fluorspar, gravel, f.o.b. mines' Illinois	ton	23.50 -.....
Ilmenite, 52% TiO_2 Va	lb.	.01½-.....
Manganese ore, 50% Mn c.i.f. Atlantic seaport	unit	.42 - .46
Manganese ore, chemica (MnO_2)	ton	75.00 - 80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y	lb.	.80 -.....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 - .08
Pyrites, Span., fines, c.i.f Atl. seaport	unit	.11½- .12
Pyrites, Span., furnace size c.i.f. Atl. seaport	unit	.11½- .12
Pyrites, dom. fines, f.o.b. mines, Ga	unit	.12 -.....
Rutile, 95% TiO_2	lb.	.12 - .15
Tungsten, scheelite, 60% WO_3 and over	unit	9.50 - 10.00
Tungsten, wolframite, 60% WO_3	unit	9.00 - 9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 - 3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 - 2.50
Vanadium pent oxide, 99%	lb.	2.00 - 14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 - 1.25
Zircon, 99%	lb.	.06 - .06½

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.13¾-$0.13¾
Aluminum, 98 to 99%	lb.	.27½- .28½
Antimony, wholesale, Chinese and Japanese	lb.	.11 - .11½
Nickel, 99%	lb.	.28 - .30
Monel metal, shot and blocks	lb.	.32
Tin, 5-ton lots, Straits	lb.	.54¼
Lead, New York, spot	lb.	.0870
Lead, E. St. Louis, spot	lb.	.0912½
Zinc, spot, New York	lb.	.0715
Zinc, spot, E. St. Louis	lb.	.0680
Silver (commercial)	oz.	.63¾
Cadmium	lb.	.70-.75
Bismuth (500 lb. lots)	lb.	2.35
Cobalt	lb.	2.50-3.00
Magnesium, ingots, 99%	lb.	.90-.95
Platinum	oz.	125.00
Iridium	oz.	275.00-300.00
Palladium	oz.	83.00
Mercury	75 lb.	59.00-60.00
Tungsten	lb.	.95-1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.50
Copper bottoms	29.50
Copper rods	20.00
High brass wire	18.25
High brass rods	15.50
Low brass wire	20.00
Low brass rods	20.50
Brazed brass tubing	24.00
Brazed bronze tubing	25 00
Seamless copper tubing	23.00
Seamless high brass tubing	22 00

OLD METALS—The following are the dealers purchasing prices in cents per pound:

Copper, heavy and crucible	10.00 @ 10.25
Copper, heavy and wire	9.87½@ 10.00
Copper, light and bottoms	8.00 @ 8.25
Lead, heavy	7.50 @ 7.75
Lead, tea	6.00 @ 6.25
Brass, heavy	5.25 @ 5.50
Brass, light	4.50 @ 4.75
No. 1 yellow brass turnings	5 00 @ 5.12½
Zinc scrap	3 75 @ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.54	$3.54
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.64	3.64

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

BIRMINGHAM—The Lehigh Portland Cement Co. has commenced additions and improvements in its local mills, to include the installation of equipment to increase the present capacity about one-third, or approximately 1,500,000 bbl. per annum. A new kiln will be installed. Headquarters of the company are at Allentown, Pa.

NORTH BIRMINGHAM—The United States Cast Iron Pipe & Foundry Co. has tentative plans for the rebuilding of the portion of its local plant, destroyed by fire, Feb. 17, with loss approximating $50,000, including buildings and equipment. Headquarters are at East Burlington, N. J.

Arkansas

PARAGOULD—The City Council has tentative plans under advisement for the construction of a municipal artificial gas plant. It is purposed to select an engineer and have plans drawn at an early date.

MAGNOLIA—The Columbia Cotton Oil Co. is said to have preliminary plans under way for the rebuilding of the portion of its local cottonseed oil mill, recently destroyed by fire with loss reported at about $130,000, including equipment.

California

REDWOOD CITY—The Pacific Portland Cement Co., Pacific Bldg., San Francisco, will commence the construction of a new cement mill on local site, to include a number of units, with main mill, stockhouses, power house, machine shop and other buildings, estimated to cost close to $1,000,000, with equipment. A contract for a portion of the work has been awarded to the Foundation Co., Holbrook Bldg., San Francisco. W. C. Stevenson is company engineer.

OAKLAND—The Michel-Pelton Co., San Francisco, manufacturer of soaps, disinfectants, etc., has secured a new building at Landregan and Powell Sts., Oakland, and will remove its plant from 639 Howard St., San Francisco, to this location, where additional facilities will be installed for considerable increase in output.

HOLLISTER—The Pacific Coast Steel Co., Rialto Bldg., San Francisco, plans for the installation of additional equipment at its local plant for the production of dolomite byproducts, including pulverizing and classifying machinery, etc., estimated to cost $25,000.

OAKLAND—A new company, headed by Theodore J. Dorsch, 283 Minna St., San Francisco, is being organized to construct and operate a plant on waterfront property, recently leased, for the manufacture of sulphur products. The initial unit will cost about $45,000. Charles E. and P. E. Black are also interested in the new organization. James Herche is engineer for the new organization.

Connecticut

NEW HAVEN—The Byron Tire & Rubber Co., 680 Chapel St., has plans for the erection of a new 1-story addition to its plant, and purposes to commence work at an early date. R. W. Fabian, 147 Bradley St., is engineer and architect.

STAMFORD—The Yale & Towne Mfg. Co., manufacturer of hardware specialties, is reported to be planning for the erection of an addition to its plant to be equipped for annealing operations.

Florida

ROCK BLUFF—C. W. Norton, Bristol, Fla., has acquired a local turpentine plant and will take immediate possession. Plans are under way for expansion, to include the installation of additional equipment. It is said that a company will be formed to operate the works.

CLEARWATER—The Common Council has called a special election on March 11, to vote on bonds for $150,000, the fund to be used for the construction of an artificial gas plant. It is expected to have plans drawn at an early date.

TAMPA—The United States Export Chemical Corp., organized a few months ago, is preparing to commence work on its proposed local plant for the production of high-phosphate fertilizers, comprising a number of units, estimated to cost close to $1,000,000. Phosphate lands in this section will also be equipped for development. The Chemical Construction Co., Charlotte, N. C., will be in charge of the project. Peter S. Gilchrist, president of the last-noted company, is interested in the new organization.

Indiana

EATON—The Eaton Paper Co. has plans under way for the construction of a new 1-story building, 60x150 ft., on local site. It is purposed to commence work in the near future. Merle Perk, Eaton, is architect.

Iowa

MOUNT VERNON—Fire, Feb. 17, destroyed a portion of the chemical laboratory at Cornell College, with loss estimated at close to $90,000. Rebuilding plans are under consideration.

Louisiana

PINEVILLE—The Board of Supervisors, Louisiana State University, has approved an appropriation of $50,000 for the construction of a new building at the institution, designed as a model sugar plant. The equipment installation, to be purchased by a separate appropriation, is estimated to cost about $150,000, to include a 36-in. mill, nine-roller type, with crusher and auxiliary apparatus.

Maryland

BALTIMORE—The North Eastern Rubber Works, Inc., 1982 North Gay St., recently organized, is arranging for the installation of a rubber-reclaiming plant in existing building, and will make purchases of vulcanizing equipment, bead cutters, pulling machines and other apparatus. William U. Saneman, Jr., is president, and John J. McCusker secretary.

Michigan

MUSKEGON—The Clover Foundry Co., Clay and 11th Sts., has preliminary plans in progress for the construction of a 1-story foundry addition, 60x170 ft., estimated to cost about $35,000, with equipment. E. N. Vanderwest, Montgomery Bldg., is architect. Charles S. Clover is president.

New Jersey

TRENTON—Fire, Feb. 16, damaged a portion of the kiln department and drying room at the plant of the Mercer Porcelain Co., Pennsylvania Ave., near Mulberry St. The estimated loss has not been announced.

New York

BUFFALO—The Linde Air Products Co., 155 Chandler St., manufacturer of industrial oxygen apparatus, has filed plans and will commence the erection of a 1-story addition to its plant, estimated to cost $25,000.

BUFFALO—The Buffalo Belt Dressing Co., 852 Kensington Ave., will construct a 1-story addition to its plant. Plans have been filed.

SYRACUSE—The Syracuse Lighting Co., a subsidiary of the United Gas Improvement Co., Broad and Arch Sts., Philadelphia, Pa., has plans in progress for the construction of a new artificial gas plant on site selected, estimated to cost close to $3,000,000, with holder, coal-gas generating apparatus and auxiliary equipment. The station will have an initial capacity of 3,000,000 cu.ft. Work will be commenced in the spring.

North Carolina

HENDERSON—The Henderson Cotton Oil Co. is reported to have preliminary plans under advisement for the rebuilding of the portion of its cottonseed oil mill, destroyed by fire, Feb. 14, with loss estimated at close to $225,000, including equipment.

Ohio

MIDDLETOWN—The W. B. Oglesby Paper Co. has completed plans for the construction of a new 3-story and basement mill,

100x100 ft. It will be equipped primarily as a rotary and beater works, with section reserved for storage service, and is estimated to cost $100,000, with machinery. Thomas H. Scott, P. A. Sorg Bldg., Middletown, is architect. Bids on general erection have been taken.

PORT CLINTON—The American Gypsum Co. is said to be arranging for the rebuilding of the portion of its plaster-board mill, near Port Clinton, recently destroyed by fire.

READING—The General Match Co., Cincinnati, O., will commence the immediate construction of its proposed local plant on the Reading Rd., for which a general contract was recently awarded to Hodges, Erwin Co., Blymer Bldg., Cincinnati. It will consist of a main 1- and 2-story unit, 200x224 ft., with 1-story building adjoining, 40x52 ft., estimated to cost about $250,000, with equipment. The H. K. Ferguson Co., Euclid Ave., Cleveland, O., is architect and engineer.

Oklahoma

MIAMI—The Eagle-Picher Lead Co., 208 South La Salle St., Chicago, Ill., has acquired a tract of about 400 acres of ore lands at Douthat, near Miami, for a consideration stated as $80,000, and plans for the installation of equipment and the development of a portion of the mining sites.

Oregon

PORTLAND—The Northwest Linseed Oil Co. has construction under way on a new local plant, estimated to cost in excess of $75,000, and plans for the early installation of equipment. It will be devoted exclusively to the production of linseed oils.

Pennsylvania

PHILADELPHIA—Fire, Feb. 22, destroyed a portion of the plant of the Eagle Leather Goods Co., 131 Market St., with loss estimated in excess of $150,000, including equipment. It is planned to rebuild.

Rhode Island

PROVIDENCE—The Sun Oil Co., Finance Bldg., Philadelphia, Pa., has commenced the construction of a new lubricating oil storage and distributing plant on the local Terminal Way, near Allens Ave., consisting of a main 2- and 3-story building, 90x100 ft., with tank house, power house and auxiliary structures for a capacity of 150,000 gal. at one time. It will cost in excess of $100,000, with equipment. A general contract for the buildings has been let to the Balchin Construction Corp., 75 Westminster Ave., Providence.

South Carolina

LOWNDESVILLE—The Huckabee, Taylor & Schumbert Co. is said to have preliminary plans in progress for the rebuilding of the portion of its local cottonseed oil mill, destroyed by fire, Feb. 15, with loss estimated at about $40,000, including equipment.

COLUMBIA—The South Carolina Weevil Control Corp., recently formed with a capital of $50,000, plans for the operation of a local plant for the manufacture of exterminator compounds for the boll weevil. L. W. Dickerson is president, in charge.

Tennessee

CHATTANOOGA—The Chattanooga Bottle & Glass Co. has plans under way for enlargements in its plant for increased capacity. Considerable additional equipment will be installed. W. H. Meacham is president.

Texas

HOUSTON—The Texas Portland Cement Co. has extensions and improvements under way at its mill, including an extension to the cooler building and an addition to the kiln department. Equipment will be installed.

WACO—The Texas Calcium Arsenate & Lime Co., recently formed with a capital of $600,000, to take over the plant and property of the Waco Lime Products Co., will commence the immediate erection of a new plant, duplicating a present unit, with capacity of about 100 tons of lime per day and about 40 tons of calcium arsenate. It will be located on site at Leon Junction, and is estimated to cost about $150,000, including equipment. S. C. Williams is president; and W. H. Hanover, McGregor, Tex., secretary and treasurer.

TEXAS CITY—The Mariand Refining Co., Ponca City, Okla., has preliminary plans under way for the construction of a new barreling plant on the waterfront, for ocean terminal service, to include the installation of mechanical equipment, automatic filling machinery, runways, etc.

Washington

SEATTLE—The Puget Sound Pulp & Paper Co. has tentative plans under advisement for the construction of a new paper and pulp mill on site near the city, consisting of a number of units, with estimated cost placed at $5,000,000. The equipment will be electrically operated, and negotiations are under way with the city for power supply.

West Virginia

HUNTINGTON—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of enameled iron and other sanitary ware products, has work in progress on remodeling and improvements in a local building at 10th St. and 2nd Ave., recently acquired, to be used as a factory branch.

Wisconsin

EAU CLAIRE—The Dells Paper & Pulp Co. is awarding miscellaneous contracts for the completion of a new 2-story mill, 80x100 ft., estimated to cost $400,000, with equipment. It is expected to have the unit ready for the machinery installation at an early date. The project includes a power dam for plant service. L. A. De Guere, Wood Bldg., Wisconsin Rapids, Wis., is architect and engineer.

To Readers of the Industrial Section

Is this section of interest to you?

A revision of the service is planned that will mean the elimination of these departments from the paper, and distribution by mail to those who find it of value.

If you wish to be included in such a distribution, write to the Industrial Editor, *Chemical & Metallurgical Engineering*, Tenth Ave. at 36th St., New York City, and specify the headings that you want.

Nova Scotia

SHEET HARBOR—The Albany Perforated Wrapping Paper Co., Albany, N. Y., known also as the A. P. W. Paper Co., is perfecting plans for the construction of a new pulp mill on timber properties recently acquired in this section, totaling more than 50,000 acres. The mill will consist of a number of buildings with power house, and is estimated to cost about $260,000, with equipment. It is expected to commence work early in the spring.

New Companies

PIANKO CHEMICAL CO., Springfield, Mass.; chemicals and chemical byproducts; $25,000. Fred G. Burnham, president; and Clinton E. Bell, 387 Main St., Springfield, treasurer.

CASCO, INC., 355 Jersey Ave., Elizabeth, N. J.; fertilizer products; $50,000. Incorporators: Ellison Crawford, Alexander R. Kellegrew and C. Lansing Hays.

GENERAL REFINING & CHEMICAL CO., 726 Penobscot Bldg., Detroit, Mich.; chemicals and byproducts, greases, fertilizers, etc.; $20,000. Incorporators: Morris Marks, Harry Love and Milton A. Bresler, 325 East Jefferson St., Detroit.

SUMMERLAND-DECKER OIL CORP., Summerland, Calif.; refined petroleum products; $500,000. Incorporators: G. H. Gobar, Fullerton, Cal.; E. E. Fleming and G. H. Turritin. Representative: Kemp, Mitchell, Silberberg & Davis, attorneys, 1126 Marsh-Strong Bldg., Los Angeles, Calif.

AMERICAN PAINT PRODUCTS CO., Birmingham, Ala.; organized; paints, varnishes, etc. W. B. Blood and F. O. Darby, both of Birmingham, head the company.

LEMOLENE MFG. CO., Dunkirk, N. Y.; polishes, etc.; $30,000, and 300 shares of stock, no par value. Incorporators: H. C. Ehlers, H. E. Nichols and G. W. Woodin. Representative: Warner & Woodin, attorneys, Dunkirk.

AMERICAN SALT & CHEMICAL CO., Galveston, Tex.; chemical products; $500,000. Incorporators: W. L. Ainsworth, J. E. Peters and J. E. Hatch, all of Galveston.

METAL EXTRACTION CO., Grants Pass, Ore.; metallurgical operations; $36,000. Incorporators: C. F. Sutter, O. J. Catherman and F. B. Sanford, Grants Pass. The last noted is representative.

BECK-DOYLE CO., 1401 State St., East St. Louis, Ill.; extracts and kindred products; $10,000. Incorporators: Jacob Beck and Frank Doyle.

ULSTER CHEMICAL SERVICE, INC., Saugerties, N. Y.; chemicals and chemical byproducts; $30,000. Incorporators: H. M. Kamp and E. N. Sylvan. Representative: C. F. Gardner, Saugerties, attorney.

LEATHERLIKE FIBRE PRODUCTS CO., Detroit, Mich.; fiber specialties; $50,000. Incorporators: N. M. McCubbin, H. T. and George E. Gagnier, 94 Moss Ave., Detroit.

PREMIER REFINING CO., Indianapolis, Ind.; refined oils; $50,000. Incorporators: Charles A. Breece, Byron C. Van Hook, and John O. Rosebaum, all of Indianapolis.

BUFFALO SINTERING CORP., Buffalo, N. Y.; refined ores; $250,000. Incorporators: R. J. H. Hutton, W. S. Reed and E. H. Letchworth. Representative: Kenefick, Cooke, Mitchell & Bass, attorneys, Buffalo.

INSECT KILLER CORP., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative; insect powders, chemicals, etc.; $1,000,000.

KENDALL CORP., West Haven, Conn.; brass, nickel and copper products; nominal capital $2,500. Incorporators: G. W. Baldwin, E. F. Lukens and William T. Kendall, 381 Ferry St., New Haven, Conn.

CADILLAC PRODUCTS CO., 1903 First National Bank Bldg., Detroit, Mich.; compounds, etc.; $100,000. Incorporators: Wedworth V. Baker, Albert P. Ball and Herman W. Bresser, 3033 Lakewood St., Detroit.

NIAGARA VEGETABLE OIL CORP., Niagara Falls, N. Y.; oil products; 800 shares of stock, no par value. Incorporators: H. E. Moxham, H. S. Steele and S. J. Lanier. Representative: Cohn, Chormann & Franchot, attorneys, Niagara Falls.

LAUMAN PETROLEUM CO., Tulsa, Okla.; petroleum products; $100,000. Incorporators: C. F. Sinks and T. B. Lauman, Tulsa.

PACKER-LITTLEFIELD GLASS CO., 1721 Sedgwick St., Chicago, Ill.; glass products; $40,000. Incorporators: D. B. Littlefield, Alfred Beck and Samuel Packer.

GENERAL ALLODIZING CO., New York, N. Y.; metal plating; 500 shares of stock, no par value. Incorporators: P. A. Degener, G. W. Martin and L. L. Gillespie. Representative: Emmet, Marvin & Roosevelt, 52 Wall St., New York.

SOUTHWESTERN LIME CO., Benbrook (Tarrant County), Tex.; lime products; $25,000. Incorporators: W. H. Slay, U. M. Simon and M. E. Smith, all of Benbrook.

CALIFORNIA CHEMICAL CO., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative; chemicals and chemical byproducts; $50,000.

PARAGON PAINT & VARNISH CORP., New York, N. Y.; paints, varnishes and oils; $50,000. Incorporators: I. Finkelman and M. Berlin. Representative: Alphonse Eckstein, 200 Broadway, New York.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

BITUMEN. Stavanger, Norway. Agency.—9332.

CELLULOSE ACETATE. London, England. Agency.—9284.

HEAVY CHEMICALS and solvents for celluloid, plastic materials, rubber, etc. London, England. Agency.—9245.

HEAVY CHEMICALS. Pernambuco, Brazil. Agency.—9210.

CHEMICAL PRODUCTS. Paris, France. Agency.—9268.

PRINTING INKS and colors. Frankfort, Germany. Agency.—9228.

NITROCELLULOSE and cellulose acetate. London, England. Purchase.—9271.

ESSENTIAL OILS. London, England. Agency.—9262.

OILS, ETHER AND TURPENTINE. Frankfort, Germany. Agency.—9228.

POLISHES, veneers and lacquers. Quebec, Canada. Agency.—9279.

CAUSTIC SODA. Danzig. Purchase and agency.—9258.